FOOD INDUSTRIES

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manufacturing and processing

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Looking Forward To New Achievements in the Food Industry

IN INTRODUCING a new magazine to manufacturers of food products the editors of *Food Industries* are aware of their obligation to offer a new service. Otherwise no useful end will be gained.

- - - The editors believe that the whole field of food manufacturing and processing is entering upon a new era in which scientific research and development are certain to play a more conspicuous part. And there is also reason to believe that economy, profit and success will follow the application of scientific principles in this industry just as they have in others. To this end it will be one function of this magazine to discuss the basic principles underlying the preparation of food, and to aid in the practical translation of those principles into processes and equipment for factory production.

PROGRESSIVE LEADERS in the food industry recognize the changing aspects of their business and are already working along scientific lines. But much remains to be done. The feeding of more than a hundred million people in this country must inevitably become a huge problem in science and economics, calling for co-operation of the best technical and business brains. Judging from experience in other American industries, success will lie in the intelligent application to production methods of scientific and engineering principles.

- - - Fortunately no industry has to rely wholly on its own resources for scientific progress and achievement, and the food industry is no exception. New ideas and methods can come from unexpected sources, and one industry can borrow and adapt them from another.

Here the editors believe that they can be of distinct service in broadening the horizon of production executives who must of necessity focus their attention on immediate and sometimes narrow problems. And just as the whole technical press has been the medium in this country through which new ideas have spread from plant to plant and industry to industry, so will *Food Industries* perform this function for the manufacturers of food products.

IN NO OTHER INDUSTRY are there more inviting problems or greater rewards for their practical solution. Methods of conservation challenge our ingenuity and resourcefulness. The elimination of waste takes on new and practical aspects. The conversion of byproducts into useful and profitable commodities becomes a subject for research and investigation. But none of these things can be achieved by reliance on hunch or rule-of-thumb. They call for all the resources of science and engineering that characterize twentieth century industry.

- - - With the editors of *Food Industries* these thoughts are more than a mere formula or catchword. They are a pledge of service to the whole field of food manufacture.

Progress by Co-operation

THERE is no industry that meets so much resistance to the introduction of improvements in quality of product as does the food industry. Trade customs, habits of consumers, prejudices and unwillingness to co-operate on the part of the buyers, and even at times federal regulations, all work against advance in methods and better products.

A Western manufacturer of tomato paste, after several years of experimental work on evaporating equipment and methods, has finally succeeded in making a tomato concentrate at so low a heat that the color, flavor and other attributes of this useful vegetable are unimpaired. The trade, however, has become accustomed to an article containing about 25 per cent solids, presumably because that made by the older process at this concentration had practically reached the limit of thickness for handling and also because older evaporating methods changed the flavor and color if the concentration was carried further.

The newer process gives a product which, at 25 per cent solids, is not as thick or viscous as that made by the older process. Hence the trade will not accept it in competition with the older processed article. In order to get the same thickness, the manufacturer must bring the new concentrate to 31 per cent solids which, although not practical in the old process, is easily obtainable in the new. The product must, therefore, compete with the established concentrate on the basis of an unimportant specification—a ruinous competition for the new paste, representing a sit does many more pounds of tomatoes per unit of volume than does the old. It should be purchased on the basis of total solids, color and taste. Actually the color and *appearance* as to thickness are the deciding factors.

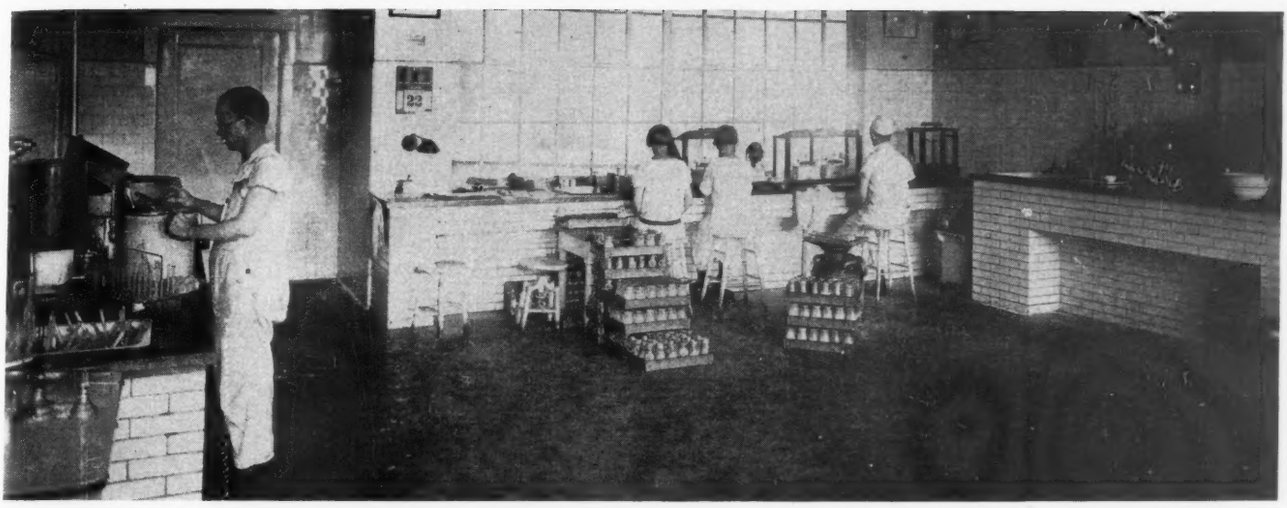
The remedy lies in the development of a spirit of co-operation on the part of the trade in the education of consumers, a willingness in the trade to aid in progress and betterment, and in sympathetic food regulations on the part of the government.

Food Preservation and the Vitamins

IT HAS been well established that in addition to fats, carbohydrates, minerals and proteins of the proper composition, certain food accessories, the vitamins, are required for the proper nutrition of the animal body. Some producers and distributors of foods have utilized this newer knowledge of nutrition to advantage in promoting consumption of their products. The public is now well informed that dairy products are rich in vitamins A and B, yeast in vitamin B, oranges in vitamin C and cod liver oil in antirachitic vitamin D. We no longer eat an abundance of these foods merely because we like them, but also because it has been proved that they are good for us.

While numerous carefully conducted scientific investigations have demonstrated that proper methods of food preservation retain practically all of the vitamins A, B, D and E, and much of vitamin C, the food preservation industries have lagged far behind the citrus fruit industries in telling the public of the fact that their products are rich and convenient sources of certain of the vitamins.

Canned vegetables are practically as rich as the fresh in vitamins A, B and E. Properly treated bottled and concentrated fruit juices and canned fruits are nearly as rich as the fresh in vitamin C. It is our belief that the consumption of these products could be materially increased with benefit to grower, manufacturer and consumer if the facts concerning their vitamin content and general healthfulness were more generally known to the public by proper and sustained methods of publicity.



Analytical laboratory in a modern creamery

Technical Control of the DAIRY INDUSTRY

Uniformity of quality and economy of manufacture made certain by scientific supervision

By W. H. E. Reid

Professor of Dairy Manufactures, University of Missouri Columbia, Missouri

MILK is the one article of diet whose sole function in nature is to serve as food. It is also the one food for which there seems to be no satisfactory substitute. It has been learned through years of diligent investigation that milk is an excellent food for man, and that the milks from several different species of mammal are used for dairy purposes in various parts of the world. In general, only cow's milk can be said to be of much commercial importance.

The magnitude of the dairy manufacturing industry may be appreciated when it is realized that in 1926 there was manufactured in the United States: creamery butter, 1,451,766,000 pounds; cheeses of all kinds, 495,021,000 pounds; sweetened condensed milk, 359,452,000 pounds; unsweetened evaporated milk, 1,373,851,000 pounds; condensed or evaporated buttermilk, 86,687,000 pounds; dried or powdered buttermilk, 31,378,000 pounds; powdered whole and skim milk, 102,486,000 pounds; powdered cream, 331,000 pounds; dried casein, 16,953,000 pounds; malted milk, 20,673,000 pounds; milk sugar, 4,476,000 pounds; and ice cream of all kinds, 398,317,714 gallons.

The real importance to the community of the milk industry is much greater than can be expressed in terms of money value, because of the supreme importance to public health of an adequate milk supply. That milk occupies a unique place in the dietaries of most children and many invalids has long been recognized. It is largely for this reason that in many states laws designed to protect the milk supply antedated general food legislation. Confidence in the milk supply and the quality of products manufactured from milk leads to better health by ensuring a more liberal use of milk.

The fat, proteins, and ash constituents of milk, in addition to the presence of vitamins A, B and C, cause its nutritive value to be of exceptional importance. There are few, if any, other foods which furnish all these vitamins in such well-balanced proportions as does milk. Milk should be used freely, especially in the feeding of children, because of its unique value as a tissue-building and growth-promoting food.

Industrial Progress Attained

The dairy manufacturing industry has experienced a greater growth than has any other industry of similar importance. With this growth, methods of production and processes of manufacture of the different dairy products have kept pace and today we find thousands of modern cheese factories, different types of creameries, ice cream, market milk, milk powder and casein plants, and condensaries located in the different states.

This increased production of milk and the manufacture of these different important dairy products has been made possible principally by almost unbelievable improvements in the methods practiced and by the inventive achievements in milk and milk products equipment. The savings of labor, time and money resulting from these improvements are almost beyond comprehension. One

need but to compare the methods practiced and the equipment used in the manufacture of ice cream today with those of but ten years ago to understand that the dairy manufacturing industry has met and conquered problems of momentous proportions. These improvements have not centered on any one particular phase of dairy manufacture, but are prevalent in every branch of the industry.

The one great objective sought by all branches of the dairy industry has been a most sincere desire on the part of all manufacturers to furnish the consuming public with a finished product of superior quality, a product that would command the esteem and respect to which all dairy products are justly entitled.

Manufacturers of dairy products today are spending greater sums of money than ever before for buildings, modern equipment, internal and external operations, qualified personnel, and especially for scientifically equipped laboratories, and for no other reason than to be in position to manufacture a product of superior quality. This highly constructive program, which has been in progress for a period of years, is very closely associated with the requisites set forth by our national, state, and local laws pertaining to the dairy industry.

Butter

The art of buttermaking, which dates back to time immemorial, has become a major part of the dairy manufacturing industry. With the beginning of this century we have witnessed numerous additional inventions and improvements of creamery equipment and methods involved, all of which have been of great service to the butter manufacturer. Some of the more important of these are the introduction of pasteurization and of the use of pure cultures of lactic acid and flavor bacteria; the American invention of combined churns and workers; the invention of artificial refrigeration and the improvement of efficient refrigeration service on transportation lines.

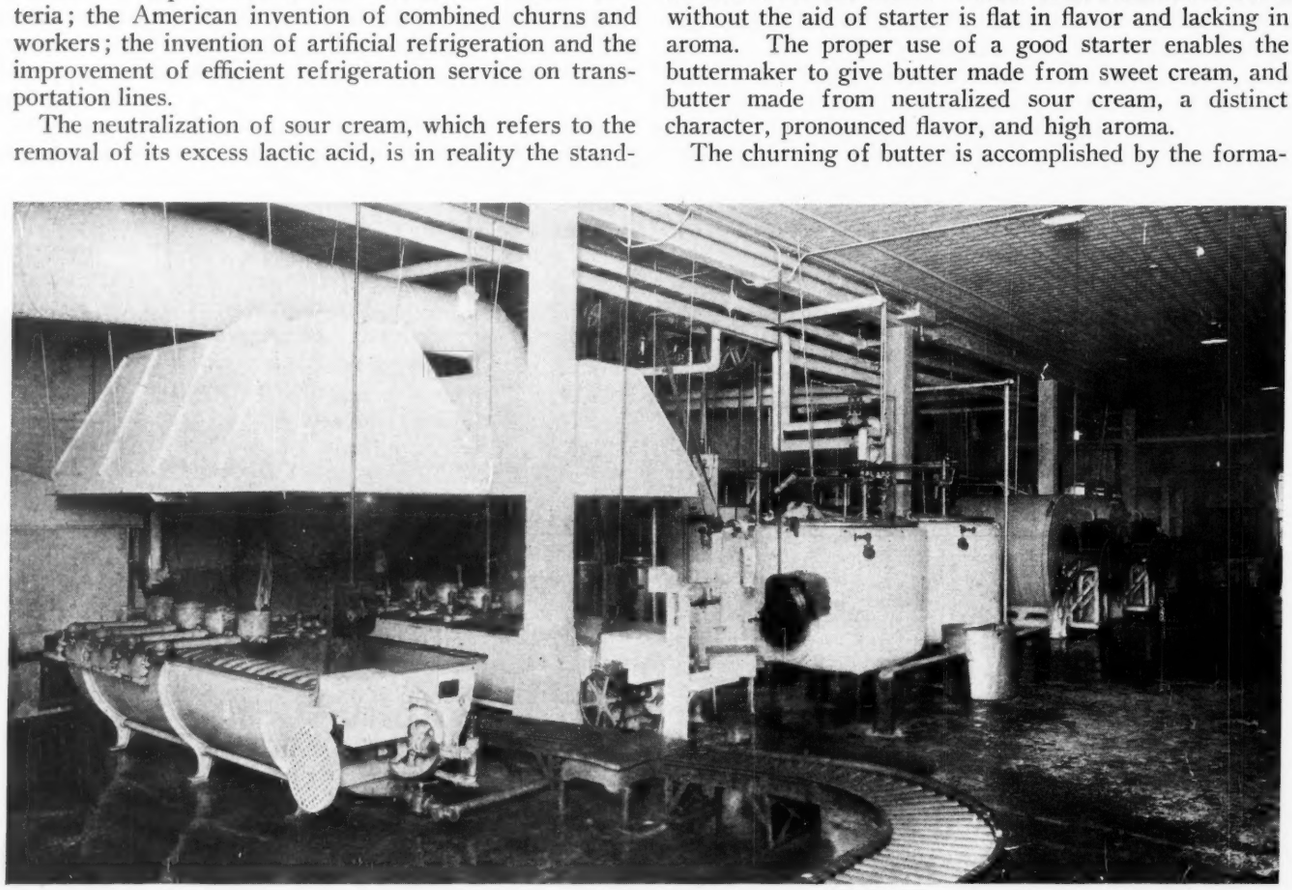
The neutralization of sour cream, which refers to the removal of its excess lactic acid, is in reality the standardization of cream for acid. This process in the creamery, which is so essential, especially in our present large centralized creameries, has three objectives: the elimination of excessive loss of fat resulting from churning cream that is pasteurized while excessively sour; protection against the production of undesirable flavors in cream that may ensue when cream that is high in acid is pasteurized at a high temperature; improvement in the keeping quality of butter made from high acid cream, the last named being the most important accomplishment of proper cream neutralization.

That neutralization of cream has been highly beneficial to the butter manufacturer is an undisputed fact. However, failure to scientifically control this process will cause results which may prove disastrous.

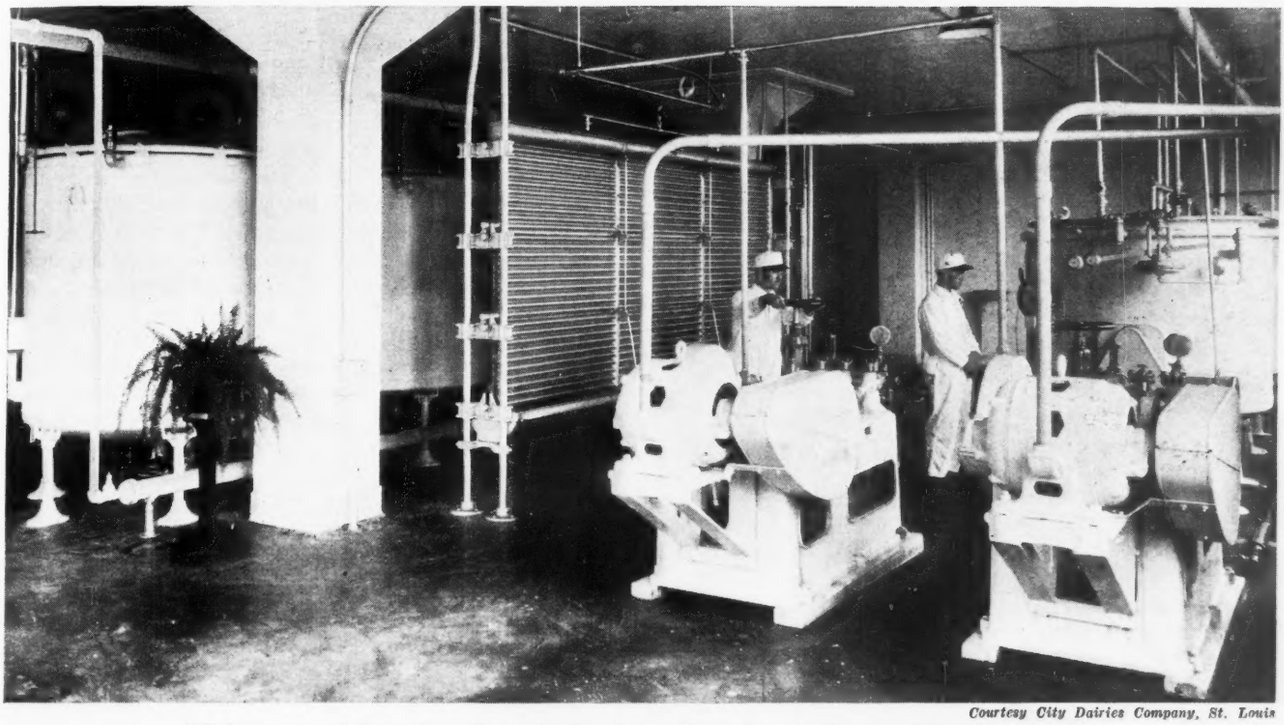
Pasteurization of cream for butter manufacture has for its purpose the prevention of disease and the checking or control of fermentation. The germs of milk-borne disease, together with the great majority of non-pathogenic germ life and other ferments present, are destroyed. Efforts to accomplish destruction of germ life in cream thoroughly enough to insure freedom from disease organisms, and to accomplish efficient control of fermentation with minimum injury to the flavor of the resulting butter, have led to the adoption of a wide range of pasteurizating temperatures.

The ripening of cream, when properly controlled, accomplishes an improvement in the aroma and flavor of the butter during its entire life. The churning process is also made more efficient and its effects on the keeping quality of the butter reflect favorably upon the process. Starters which "seed" the cream with species of bacteria are capable of producing in the cream and butter the desired flavor and aroma. Butter made from sweet cream without the aid of starter is flat in flavor and lacking in aroma. The proper use of a good starter enables the buttermaker to give butter made from sweet cream, and butter made from neutralized sour cream, a distinct character, pronounced flavor, and high aroma.

The churning of butter is accomplished by the forma-



Manufacturing department of a creamery showing receiving vats, flash pasteurizers, ripening vats and churns



Courtesy City Dairies Company, St. Louis

Mixing room of ice cream plant showing pasteurizers, homogenizers, cooler and aging vats

tion of butter granules and the elimination of the bulk of non-fatty constituents of milk or cream. Actual formation of the butter is brought about by crystallization of the fat in the fat globules and by the coalescence of the partly or wholly solidified fat globules into larger aggregates or butter granules. All of this is accomplished in the churn.

The foregoing processes applicable in butter manufacture represent the most important steps to be practiced. The receiving, grading, sampling, and weighing of the cream; the washing, salting, working, and packing of the butter; all are additional essential steps.

These processes could not be performed efficiently were it not for the presence of the modern well-equipped laboratory in practically every creamery or butter factory. The laboratory operator, the plant men, the efficiency experts who are in the employ of the larger creameries; all look to the laboratory for guidance in the performance of their respective duties. Tests and analyses such as fat determinations of the cream and buttermilk; acidity tests of the cream at definite intervals, as a guide in neutralizing and ripening of the cream; analyses of the butter for moisture, salt, fat, and acid; analyses of the starter for aroma, flavor, body, and gas; all are direct reflections of what is termed the technical control of the butter industry. The laboratory serves as a medium for the physical, chemical, and bacteriological analyses of the products and processes involved in its production.

Ice Cream

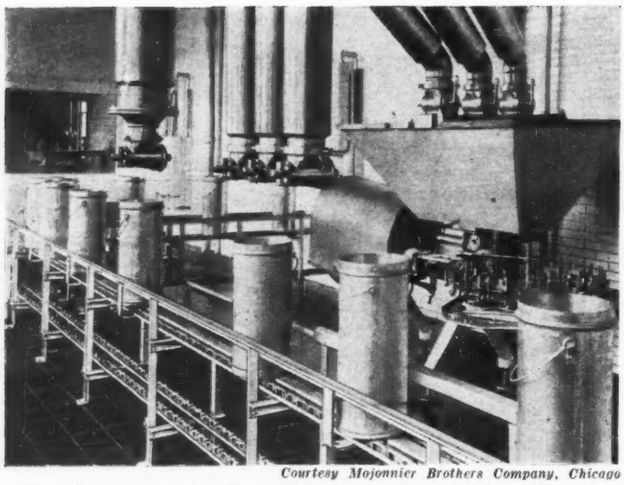
Development of the ice cream industry did not originate as a spontaneous invention; rather it is the result of a gradual evolution in the making of cold beverages and ices. Ice cream has a legitimate place in our nutritional plan as is proved by the known facts regarding the food value of its constituents. Each year sees not only a larger capital investment in the industry, but a larger investment per gallon of ice cream manufactured. The time is not far distant when nearly all ice cream will be made in large quantities, with an accompanying need for proportionally large amounts of capital. As a result, the ice cream industry is passing out of the period of small scale production.

The ingredients most commonly used in ice cream manufacture are pure sweet milk, sweet cream, skim milk, condensed and evaporated milks, milk powders, sweet butter, sugar, and gelatin. Other ingredients may be used, depending upon their purposes and the kinds of ice cream, sherbet, or ice to be manufactured.

The ice cream manufacturer who is operating his plant efficiently requires all products composing his ice cream mixture to meet certain definite standards as to their aroma, flavor, body, acidity, fat, solids-not-fat, and total solids content. These standards are rigid because of the desire of the manufacturer to give the consuming public a satisfactory product and to eliminate any losses that would occur in the plant should an inferior product be accepted.

The alert ice cream manufacturer has also a certain standard for his product. All processes involved in the choice of his raw materials, their receipt, and subsequent processing are performed with that standard clearly in mind. The adoption of a standard, however, does not lend assurance that the quality of the product will always be maintained. It is the first essential in the manufacture of a satisfactory product, the second being to secure ingredients of the right quality.

There is no great difficulty involved in obtaining the necessary ingredients. The greatest problem confronting every manufacturer is to combine the ingredients properly as set forth by the standard adopted, and then to process the mixture skillfully. Knowledge of true solutions, colloidal solutions, suspensions, and emulsions should be gained; otherwise the chemical and physical treatments that the mixture receive are not clearly understood. The acidity of the ingredients entering the mixture; the acidity of the complete mixture; the desirability of neutralizing; pasteurization temperature, and the time of holding at this temperature; pressure to be applied in homogenizing or viscolizing the mixture; method of cooling; tem-



Courtesy Mojonnier Brothers Company, Chicago

Freezing room showing automatic mix weighing devices, freezers, and hoppers which convey ice cream to floor below

perature to which mixture shall be cooled; length of aging period; all are matters as to which decisions must be rendered. These problems are concerned with the several steps of ice cream manufacture prior to the actual freezing process.

The freezing of ice cream is, apparently, a definite mechanical process; yet it involves complexities, many of which are well understood and others yet to be determined through research and practice. Quality of product and "overrun" are the two objectives sought in the freezing of an ice cream mixture. When it is known that no less than forty factors may affect the amount of water taken up by the mixture during its processing and termed its "overrun," it can be appreciated how intricate is the freezing process of ice cream manufacture.

A large number of modern ice cream factories employ a man to serve as production manager. This person is usually a highly technical man whose primary duty is to control all conditions in the plant that reflect themselves in the quality and yield of the finished product. Were it not for the presence of the production manager and his laboratory, valuable information could not be obtained, such as the quality and composition of raw materials, analysis of the mixture prior to freezing, bacteriological control of plant conditions, bacterial content of the ice cream, "overrun" yields, unit cost of manufacturing ice creams, sherbets, and ices, unit cost of fruits, and control of factors which may cause a fluctuation in the "overrun" from the different freezers.

Cheese

Cheese, which is a solid or semi-solid protein food product manufactured from milk, depends for its solidity upon the curdling or coagulation of part or all of the protein and the expulsion of the whey. The coagulum or curd so formed incloses part of the milk serum or watery portion of the milk, part of the salts, part or all of the fat and an aliquot part of the milk sugar.

Cheeses of various kinds—and it is estimated that there are at the present time 318 distinct varieties—preserve the most important parts of the milk in condition for consumption over a very long period of time. The duration of this period and the ripening and other changes taking place depend very closely upon the composition of the freshly made cheese. There is an intimate relation between the water, fat, protein, and salt content of newly made cheese and the ripening processes which produce the particular flavors of the product when it is ready for the consumer. This relation is essentially biological.

The major problems involved in cheese manufacture are of a very complex nature. These include the chemical composition of milk, the nature of rennet used for causing coagulation of the milk and the character of its action under conditions met in cheese-making, the nature of the micro-organisms in milk, and the methods of controlling them, their relation to acidity and to the ripening of the cheese. To these scientific demands must be added a thorough acquaintance with the technique of the whole milk industry, from its production on the farm through the multiplicity of details of factory installation and organization, to those intangible factors concerned with the texture, body, odor, and taste of the varied products made from it. The latter is especially true in cheese manufacture.

The most serious defects prevalent in cheese, and these defects can be treated in a general way inasmuch as they may become apparent in the different varieties, are defects in flavor, body, texture, color, and finish.

The defects in flavor can be attributed primarily to the presence of undesirable types of bacteria and certain yeasts, although poor workmanship often produces undesirable qualities not characteristic of high quality cheese. Control of the raw product by exacting methods and rigid application of these methods as they apply to the production of a good quality of milk will remove the major flavor defects. Control of factory processes and bacteriological control of factory conditions should minimize the remaining undesirable flavors.

Cheese characterized as being moist and dry in body is considered either too hard or too soft, due to the presence of too little or an excess of moisture. The prevention of these body defects is dependent upon proper control or manipulation of those operations of curd making that affect the moisture content of the cheese. Thorough understanding of moisture control will assure an early correction of body defects in cheese.

An open or loose textured cheese reflects the ability to control processes of manufacture. A cheese possessing these defects is high in moisture, soft and weak in body, and contains many mechanical holes. This condition in the cheese may be desired by some few markets while others offer a strong objection to it. The causes may be said to be of a physical, biological, and chemical nature, and can be prevented when desired by performance of routine tests suitable for the purpose.

Variation in the color of cheese, although not usually considered as serious as defects in the flavor, body, and texture, should always receive careful observation. Differences in color may appear in both colored and uncolored cheese, and can be corrected by the cheese maker who will endeavor to control his different processes in the manufacture of his product.

Ability to control the preceding processes is often lost, in part, when the finish of the cheese is somewhat lost sight of. A cheese that presents an outward appearance other than one that is neat, clean, and attractive may cause the application of a penalty which may very materially affect its sale price.

The smaller cheese factories of today maintain a laboratory capable of determining the fat and the sediment content of the milk and the presence of gas-producing bacteria and moisture content of cheese. With the marked growth of the cheese industry, the larger factories are installing laboratories completely equipped to perform

analytical and bacteriological analyses of their product to the end of controlling conditions pertinent to the production of the raw products and the processing involved in the manufacture of cheese.

Condensed Milk

Condensed milk is cows' fresh milk from which a considerable portion of the water has been evaporated and to which sucrose may or may not have been added. In sharp contrast to the manufacture of butter and cheese, condensed milk is a product of comparatively recent origin.

Since the introduction of the process of milk condensing, numerous modifications of the process, as well as entirely different processes, have come into use in this country and abroad. The basic principle of the process of manufacturing condensed milk is the heating of the milk under vacuum for the purpose of removing a definite part of the original water content, the product being subsequently canned, sterilized, and cooled.

The requirements governing the production and receiving of a satisfactory raw product are essentially those of the cheese and butter industries. None but the highest quality of raw milk is acceptable and the prices paid the producer for his milk are in keeping with its quality. Due consideration is given those factors that may affect the milk constituents as a uniform raw material must be used if the resulting condensed milk is to prove satisfactory.

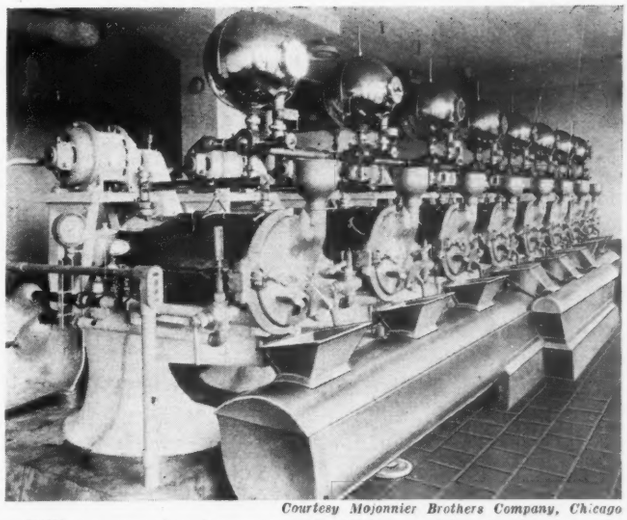
Prior to the application of heat the milk is accurately standardized to insure in the finished product the percentage relation of fat to solids-not-fat that meets the standard requirements. The vacuum pan and pump are used in condensing the milk and the process practiced is essentially the same as in the case of sweetened condensed milk. Frequent tests are made of the product under process, and the evaporating continued until a certain density is reached.

Evaporated milk is homogenized in order to avoid separation of the butterfat after manufacture. This is accomplished by forcing the milk under pressure through exceedingly small openings, resulting in a disintegration of the butterfat into minute globules, thereby preventing their rise to the surface, by a partial destruction of their buoyancy to the extent that they are unable to overcome the resistance of the surrounding liquid.

The cooled, evaporated milk is filled into tin cans, sealed, tested for possible leaks in the cans, and then sterilized at a temperature approximating 235 deg. F. for the purpose of destroying all germ life, and thereby preserving the product permanently. Successful manufacture of this product depends to a very large extent upon the efficiency of the sterilizing process, a process which changes the physical properties of the milk and has a tendency to minimize the separation of the fat.

Control of the processes and methods practiced in the manufacture of condensed and evaporated milk is developed to a nicety equal to the manufacture of any other dairy manufactured product. The methods practiced and the use of equipment and highly sensitive instruments make possible the technical control of the entire procedure of manufacture. Ability to control conditions with such accuracy assures the manufacture of a product of uniform quality at a minimum unit cost.

During recent years the milk powder industry has experienced the greatest growth of any one phase of dairy manufactures. This growth has been due primarily to the improved processes resulting in the manufacture of a higher grade of powder, and secondly to the great demand for milk powders, particularly skim milk powder. This demand has come from the ice cream, bakery, and candy industries, which have been enabled to improve markedly both the quality and yield of their respective products by the addition of skim milk powder to their original mixture.



Courtesy Mojonnier Brothers Company, Chicago

Filling room showing automatic filling machine for packaged ice cream or ice cream in different sized cans

Powdered Milk

The fundamental purpose of milk powder manufacture is to preserve milk as nearly as possible in its natural condition, and to reduce the original volume to the minimum, thereby making possible its economical transportation to all parts of the world. Removal of the water by evaporation to less than two per cent of its original content from cows' milk, or from milk with part of all of the cream removed, produces dry milk, desiccated milk, dehydrated milk, or milk powder. A similar product has been made from cream and is known as cream powder.

Powdered milk should be simply fresh milk with the water removed, and when the water is restored the product should be indistinguishable from the original milk. That is, the physical and chemical properties, as well as the nutritive value, should be unchanged, and nothing should be present that was not contained in the original milk.

The perfection of processes applicable for the commercial manufacture of milk powders is of comparatively recent origin. Several different processes are now practiced in the manufacture of this product. Although it is possible to manufacture dried milk by cold, this procedure has not reached the commercial stage. The processes of desiccating milk by the application of heat that have attained commercial recognition, can be grouped as the dough drying, film drying, and spray drying systems.

A number of these are confronted with the difficulty of manufacturing a product that may be considered highly soluble. The solubility of the finished product is impaired by certain processes because of the necessity of using high temperatures.

High temperature and drying affect the properties of colloids such as calcium caseinate and lactalbumin, making them incapable of redispersion when water is added to the powdered milk. The colloidal properties of milk constituents demand a process using the lowest possible

temperature, and exposure of the milk to heat for the shortest possible time. The spray drying process which is now in very wide use fulfills these requirements to a very marked degree, and produces a powdered milk in which the original colloid properties of the milk constituents are almost completely retained. The solubility of the product manufactured by this process is said to very closely approximate 100 per cent, indicating that none of the protein coagulates during the process, and the product retains its much desired dispersion properties. Vitamins A and B are not destroyed by the temperature used by the spray drying process.

Powdered milk is intended primarily to serve as a substitute for fresh milk. Ability to regulate supply according to demand would eliminate, in toto, city distribution of fluid milk. The financial saving to the producer and consumer would be tremendous. Fresh milk, upon its delivery at a conveniently located drying plant, would be converted into milk powder and packed in suitable containers of various sizes as demanded by the consumer.

The value of maintaining accurate and continued control of every phase of the process of milk powder manufacture is quite obvious. The quality of the raw product must be under absolute control as should be every subsequent process. There is no branch of the dairy manufacturing industry that appreciates more the value of technical control of its manufacturing processes than does the milk powder industry. Their laboratories are complete to the extent of being capable of performing all necessary chemical, physical, and biological analyses. Ability and desire to maintain complete control of all processes has placed the milk powder industry upon a very high plane, as is evidenced by the quality of the product manufactured by the more improved processes.

Casein

Casein is seldom manufactured except when a surplus of skim milk is experienced, unless an unusually good market for this product is available. This milk protein, in the form of cheese, has for a great many years formed an important part of the dietary of the human race and has been manufactured in very large quantities. Its technical utilization, however, has been almost entirely neglected.

Casein, which is insoluble in milk, is suspended in a state of distension which determines the entire behavior of milk. This constituent is the cause of certain physical properties of milk, notably the viscosity, which influences the rate at which the butterfat of milk rises.

When thoroughly dry, casein can be packed and stored in a dry room for an indefinite period, without undergoing alteration. The many different uses to which this product is put signifies its importance in the commercial world. Control of its processes during manufacture is imperative and results in the production of a product of uniform quality.

A relatively small portion of the total volume of milk produced is utilized in the manufacture of such byproducts of milk as malted milk and milk sugar. The malted milk industry is, however, growing and indications are that it will come into real prominence in the near future. The recovery of the solids of whey from cheese is very recent. Previously, whey was used for stock feed or wasted. The process of recovery of the solids involves the same equipment as is used in the manufacture of spray process milk powder.

Realizing that the nutritive properties of the very complicated and easily altered constituents of milk are likely to be changed, manufacturers of milk products are very apt in their desire to have under control every process pertinent to the production of milk and the manufacture of the many different milk products.

The engagement of skilled technicians to direct and control complicated plant operations, as they pertain to the manufacture of butter, cheese, ice cream, condensed milk, milk powder, casein, and other products, is indicative of the plant executive's realization that obsolete procedure can no longer be tolerated. A continuance of many former methods in our several different types of dairy products manufacturing plants will incur tremendous financial losses, dissatisfaction among the plant personnel, and the manufacture of an inferior finished product.

The standards used in choosing the plant personnel in the dairy manufacturing industry are on a high plane. Installation of modern equipment, the operation of control laboratories in each plant, demands of the consumer for a product of high quality, the desire of the manufacturer to improve his plant operations, making possible the manufacture of a superior product at a minimum cost, requires the employment of men who are experts in their respective fields.

The efficiency with which high quality raw product is obtained, the marked decrease in factory operating costs, the manufacture by the respective phases of the dairy industry of enormous volumes of a uniformly superior product, the conception and adoption of improved plant processes, the invention of time saving and labor saving machinery; all are commendatory reflections of the technical control of the dairy manufacturing industry.

Dairy Bureau's New Chief Outlines Needs of Industry

"The important factors that need attention in the dairy industry today are greater efficiency in production, production of the highest quality in dairy products, and increasing the consumption of dairy products," is the recent statement of O. E. Reed, Chief of the Bureau of Dairy Industry, U. S. Department of Agriculture.

"The need of more economic and efficient production is quite apparent on every hand," he said. "The dairy farmer must cull out the low-producing cows from his herd and build for a greater production for each cow through keeping records of production, by using better sires, and by following the best methods in feeding, breeding and management. The same problems must be considered by the manufacturer and distributor of dairy products.

"The quality of dairy products must be given more consideration. The farmer is responsible for the quality of the product as it comes from the farm. The manufacturer and distributor are responsible from that point on until it reaches the consumer. Dairy products are perishable and the demand depends upon quality.

"The work of the Bureau of Dairy Industry is designed to add information through research and investigation to help with a program of this kind. The bureau's efforts, together with results of research carried on by all other organizations of the industry will do much to help solve these problems, but this alone is not sufficient to guarantee success in this work," said the new chief.

Desiccating Shredded Coconut

How the Franklin Baker Company effects economies by exact regulation of the drying process

By A. E. Buchanan, Jr.

PREPARATION of coconut for domestic, confectionery, and bakery consumption is primarily a process of drying. It is a far cry, however, from the trays of copra drying under a tropical sun to the modern mechanical driers of the Franklin Baker Company, whose plant in Hoboken, N. J. produces the delicate shredded coconut in the various forms demanded by the critical American palate. Here, drying has been refined to an exact science, an up-to-date laboratory exercising rigid control over the moisture content, with the result that loss due to spoilage en route to the consumer, formerly expected and considered inevitable, has been eliminated. Only one familiar with the capricious nature of coconut meat, its susceptibility to rancidity and spoilage, can appreciate the respect, almost approaching reverence, with which the control laboratory is regarded at the Franklin Baker factory.

The Hoboken plant is a unit of the Postum company, Inc. which, by virtue of its recent consolidation program, occupies a leading position in the food industry. From the nucleus of the original Post line of cereal foods and beverages, the Postum company has absorbed the Cheek-Neal Coffee Company, Nashville, Tenn.; the Sanka Coffee Corporation, Brooklyn, N. Y.; Walter Baker & Company, Ltd., Dorchester, Mass.; the Log Cabin Products Company, St. Paul, Minn.; the Minute Tapioca Company, Orange, Mass.; the Jell-O Company, LeRoy, N. Y.; Igleheart Brothers (Swans Down Flour), Evansville, Ind.; and Richard Hellmann, Inc., with six mayonnaise factories strategically located from Coast to Coast. Impressive as is this expansion of the parent company, it is equalled in interest by the growth of the Franklin Baker Company from an almost accidental beginning.

In 1895 the Cubans were in revolt and business on the island was seriously depressed. Franklin Baker, a Philadelphia flour miller who exported largely to the West Indies, was advised by a Cuban customer that conditions in that country prevented cash remittance and that a cargo of fresh coconuts was being consigned to him in settlement. Finding it impossible to dispose of the shipload

of coconuts, Baker determined to market them himself and, buying a small shop in Philadelphia, he began the desiccation of grated coconut. Fresh from college, Franklin Baker, Jr. joined his father in 1899 and built up the business that is largely responsible for the establishment of this tropical delicacy as a staple confection. Franklin Baker, Jr. is now a director of the Postum company.

Shiploads of coconuts are still being consigned to the Franklin Baker Company, but today they are delivered by diesel-motor ships, chartered for the purpose, from the West Indies and Central America. The company owns extensive plantations in the Philippines and operates three plants in the islands where the crop is shredded and desiccated for shipment in bulk to the plants in Hoboken and Montreal and to the baking and confectionery trades. The nuts from the West Indies and Central America arrive in their shells, from which the outer husks have been stripped, and are unloaded at the company's pier in the Hudson River adjoining the factory.

Burlap bags are employed in unloading the coconuts, from 80 to 120 nuts, depending on size, comprising a standard bag. This unit has been found the most convenient size for handling and for measuring the production of workers, all of whom are paid on a piece-work basis. Bags are loaded from the dock directly into a bag conveyor, inclined against the north wall of the factory, which elevates them almost vertically to the ninth floor where they are discharged to the storage room.

The Plant

Gravity "flow" is strikingly in evidence in the routing of all materials at the Baker plant. The building is a substantial ten-story structure of reinforced concrete, completely modern, light, airy, and fireproof. Executive and other offices occupy the top story, operations beginning on the floor below where the large storage space provides the flexibility necessary to maintain a regular production schedule notwithstanding the irregularity of supply that must be anticipated when the raw material is transported half around the world by sea. Bags are handled on hand trucks and are delivered by chute to the floor below.

At this point in the process, where the meat must be removed from the shell, it may be well to digress for a moment, for here certainly is employed the most highly specialized technique of the business. With the possible exceptions of certain other nuts and shell-fish, it is difficult to call to mind any other foodstuff that greets the processer in so formidable a natural packing. Anyone who has undertaken the removal of coconut meat from the shell with ordinary domestic implements retains an appreciation of the difficulties involved, first in breaking the rugged shell and then in detaching the meat. The perfection of Nature's packaging process is further testified by the fact that there exists within the coconut a vacuum, sometimes reducing the ordinary 15-pound pressure per square inch to about half that figure. This phenomenon, peculiar to the coconut, is presumably due to the absorption of part of the milk during growth. The milk, incidentally, presents an important problem and one that renders necessary the scrupulous cleanliness that is maintained throughout the plant, for it is sweet and sticky and begins to ferment as soon as it is exposed to the air. This latter property is well and favorably known to the natives of the coconut countries, who encourage the bacterial action to produce a potent beverage known as "toddy." In the factory, however, where bacterial action is constantly fought, the work tables and floors of the opening department must be washed down frequently to remove the milk that spatters from the nuts as the shell is shattered.

Manufacturing Operations

Delivered to the opening department, the bags of nuts are placed in steam cabinets and subjected to a temperature of 212 deg. F. for half an hour. These cabinets are constructed of sheet iron with sliding doors, and are supplied with exhaust steam from the power house. Steaming loosens the tenacious bond between the coconut meat and the shell, facilitating the opening operation. The bags are now opened, the nuts distributed to the opening tables, and the empty bags dropped to the floor below to be dried in a steam heated mechanical drier.

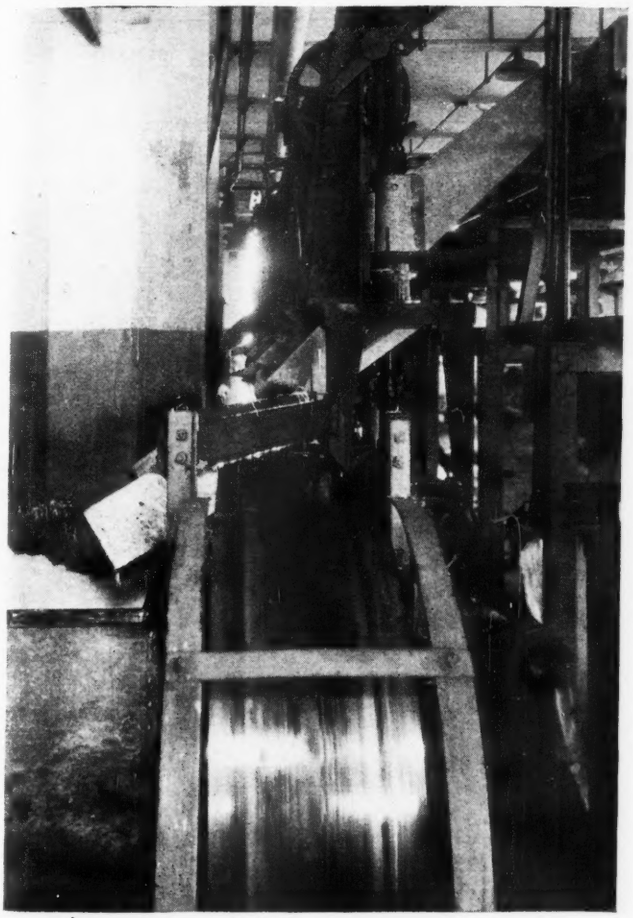
The delivery end of the coconut shredder

Working with a small tool similar to an oyster knife, the line of "openers" split the nut and with remarkable dexterity pry the meat out of each section of shell, generally in one piece. Experienced male operators are used in this work, standing beside long tables equipped with bins supplying the nuts and with chutes into which the shells are dropped to the floor below where they are carried on a belt conveyor before an inspector who retrieves any pieces from which the meat was not completely removed. Milk from the opened nuts is collected and used in one of the more recent additions to the Baker line—shredded cocoanut packed in its own milk. The opening operation resembles nothing so much as a mammoth oyster bar, with scores of operators opening huge and recalcitrant bivalves.

A tough brown skin covers the nut meats and must be removed before the material is processed. This second manual operation is carried out by skilled girl workers seated at work benches adjoining the opening tables. Nut meats are delivered to a bin before each operator who pares off the brown skin with a few dexterous strokes of a sharp, slightly curved knife. Rich in cocoanut oil, the parings are consigned to a chute which drops them to the floor below where they are fed to a mechanical drier in preparation for the oil extraction. As previously stated, most of the nut meats are removed from the shells in large pieces with the result that the pared nuts are roughly spherical and obligingly roll down galvanized iron troughs

to the floor below. In fact, from this point in the operation all material is handled in bulk and practically every operation is mechanical.

Carried on a belt conveyor, the nut meats are thoroughly washed by passing under brisk water sprays. An operator stationed at the exit of the scrubbers removes

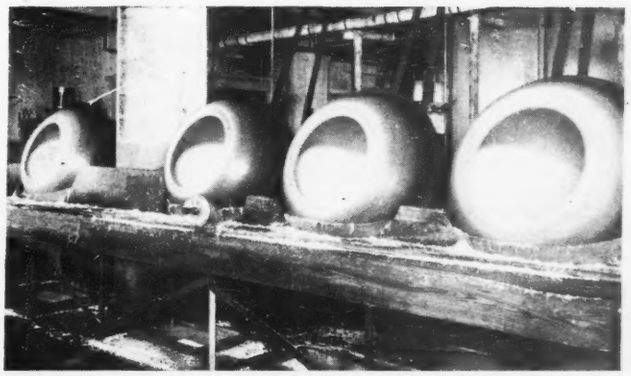


Belt conveyors are used wherever practicable

any that have come through without perfect paring and those that are off color or otherwise below the standard of excellence demanded for processing. Due to the perfection of the coconut's natural packing and the skill of the manual operations, the percentage of rejected material is comparatively small.

The selected nuts are conveyed by gravity to the next lower level, meeting there a horizontal conveyor which supplies the battery of shredding machines. Each of these ingenious cutters, designed especially for this purpose, consists fundamentally of a disk, rotating horizontally, in which three knife blades are set at an angle. Across the cutting edge of each blade is a row of closely spaced vertical slicers, the general appearance being reminiscent of the familiar safety razor. This cutting disk rotates at the bottom of a chamber into which the nut meat drops and is then pressed against the knives by a descending piston. A coconut is reduced to the desired size in 2 or 3 seconds, being thrown from the machine in a miniature blizzard of fluffy shreds. A belt conveyor serves the battery of shredders, carrying the product to a galvanized iron tank truck which is rolled to the sweetening operation nearby.

Rotating copper drums are used for incorporating the sugar, the coconut shoveled in from the trucks and



Where the sugar is added to the shredded coconut

tumbled for 20 to 30 minutes. It might be pointed out here that in coconut plants materials for equipment present no corrosion problem, the product being so rich in natural oil that it coats all containers with a protective film. Refined cane sugar is used for sweetening, a step which brings out the delicate flavor of the nut. A small quantity of salt is also added for the same purpose, and glycerin is incorporated to render the shreds less brittle. When the tumbling is completed the drums are dumped into the trucks again and the product rolled over to the adjacent driers.

Three large Procter and Schwartz driers, especially designed for this product, handle the entire production of desiccated coconut. They are provided with endless belts of galvanized iron screen moving through the driers at a speed of 2 feet per minute. Moist material is shoveled upon the screen and spread out to a depth of about 2 inches. Entering the machine with about 45 per cent of moisture, the coconut is warmed and dried by the passage of conditioned air and finally cooled. The maintenance of the proper moisture content is the fundamental secret of a consistently satisfactory product, for coconut in this condition is not subject to rancidity or infection by insects. Yet it was not until a chemist and a control laboratory were attached to the production department that the variations in moisture content of the product, not detectable even to the experienced operator, were discovered and found to be responsible for the periodical complaints of customers. In the words of T. M. Rector, plant chemist at Hoboken, "the adoption of scientific methods for moisture control was the most important improvement this plant has made."

The Control Laboratory

Two chemists comprise the regular personnel of the control laboratory, one man devoting his time to the routine operating tests and the other to research problems. From 20 to 50 samples of coconut are taken each day for moisture determinations. The bins in which the finished product is stored are divided into small units which are numbered systematically, analyses being made of each section before the material is passed for packing in its containers. The samples are taken by the foreman who collects a few ounces of coconut from several parts of the section, both near the surface and deep in the heap. Samples are sent to the laboratory in moisture-proof tin containers, the determinations made in a vacuum oven and the results reported back to the foreman within an hour after the samples are taken. In addition to the moisture tests, the control chemist runs periodical determinations of the oil content of the copra meal produced

in the oil mill and of the free fatty acid content of both crude and refined oil. As described below, some of the coconut is packed in an atmosphere of carbon dioxide and the determination of the percentage of this gas in the cans is another of the control chemist's regular duties.

Grading and Storing

Following the drying operation, the product is screened to separate it into four grades, differentiated by the length of the shreds. A shaking screen, inclined slightly from the horizontal and vibrated by a motor and eccentric, is used, the upper of three sieves retaining the longest fibers and the bottom screen passing the very short shreds and "dust."

Dropping from the screen to the floor below, the product is piled in large galvanized iron bins for blending and equalizing the moisture content. This storage space also provides a flexible link between the processing and packaging departments, the latter being located on the floor below and supplied with finished coconut as needed. Desiccated coconut, comprising about 75 per cent of the plant's production, is marketed in barrels, tins, and cardboard boxes. Because of the high oil content, glassine paper liners are used.

Among the most appetizing varieties of the Baker products should be mentioned the crisp, brown, toasted flakes, in demand largely by the candy trade. Nuts for this purpose are chipped, rather than shredded, and spread over trays stacked on a carriage which is then rolled into gas-fired toasting ovens.

The packing departments occupy the lower floors of the building and are equipped with the most modern automatic machinery, some of it designed by the engineers of the Franklin Baker Company and incorporating novel "kinks" of their own.

Packing the Product

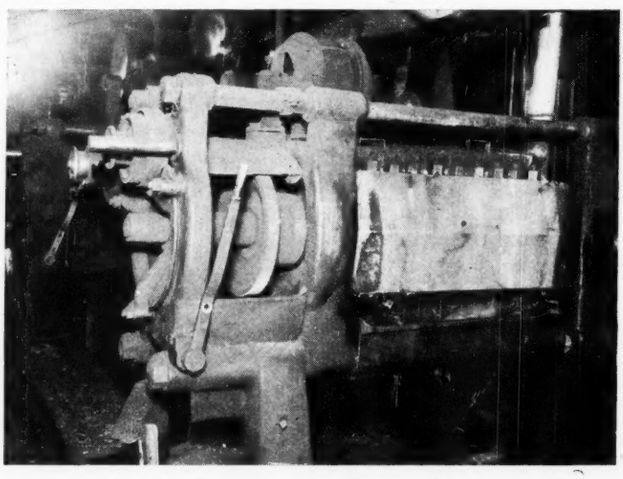
It is not within the province of this article to describe the packaging operations in detail, but mention should be made of the process for packing perishable products in carbon dioxide which was developed by the Franklin Baker Company and first used for packing moist coconut.

It is obviously desirable that coconut for certain purposes should reach the consumer in its natural, moist condition. Difficulties previously described made this impracticable until it was found that the sealing of the product in an atmosphere of carbon dioxide gas prevented bacterial action and consequent rancidity. As the gas is invisible, tasteless, odorless, and chemically inert, it does not affect the product; indeed, the average customer does not even know that the product is preserved by the "Vitapack" process. The machine developed for this modern method of packaging is extremely ingenious and comparatively simple. Cans are fed by conveyor in the usual manner under the charging hopper which supplies the exact amount of product desired. Lids are then laid loosely over the open tops of the cans which pass next to a turn-table and are covered by air-tight bells. The first position on the turn-table is for evacuation of the air; in the next position the bell is filled with pure carbon dioxide. Although the lid is still but loosely in position, the density of carbon dioxide, which is considerably greater than that of air, permits the passing of the cans to the sealing machine which crimps and solders the covers. Carbon dioxide gas for the process is purchased in steel pressure cylinders which are conveniently and safely handled. Present production of the moist brand of coconut at this plant requires about 2,000 cubic feet of gas per day. In addition to this application, however, the Franklin Baker Company has extended the use of the process to other of its packing problems, such as the shipment of cashew, pistachio and other nuts from its foreign depots and to customers. The unqualified success of the system would seem to indicate that it will find wide application in the industry for the distribution of perishable products. The "Vitapack" process is now marketed by the American Can Company.

Byproducts

As to the byproducts of the Franklin Baker plant, coocnut shells are in constant demand by the makers of activated carbon, the compact texture of such shells producing the best grade of carbon. Developed for use in gas masks during the World War, this substance is finding ever widening application as an absorbent, decolorizer, and deodorizing medium. The fragments of skin sliced from the nuts are dried at 180 deg. F. in a mechanical drier and dropped to the ground floor where is located an efficient little plant for the extraction and refining of coconut oil, much of which finds its way to other food industries, since it is a vegetable oil that is easily and completely digested. The parings at 150 deg. F. are elevated by a screw conveyor to the hopper over an Anderson expeller in which the oil is pressed out by the action of a screw, the residual cake—an excellent cattle feed—being discharged continuously. Due to the comparative freshness of the parings, the fatty acid content of oil thus extracted averages between 0.5 and 1.0 per cent as compared with a range of 1 to 8 per cent in that from imported copra. Various grades of oil are produced according to the demand. The refining process consists of a settling period, washing and settling again, and removing color and odor by treatment with activated carbon.

In its natural habitat the coconut palm supplies primitive man with his food, drink, raiment, oil, wine, building material, twine; practically everything necessary to his existence and comfort being obtained from this species of tree. This highly utilitarian background harmonizes well with the modern operating economies employed by the plant under discussion, in which waste products have been practically eliminated.



Certain of the waste products yield coconut oil

For the pleasant privilege of inspecting this immaculate factory, the writer is indebted to Messrs. Franklin Baker, Jr. and T. M. Rector, plant chemist.

PACKAGING PROBLEMS *of* CONFECTIONERY

A careful analysis of what must be done to insure safe handling and marketing of all sugar products

By STROUD JORDAN
Chief Chemist, Henry Heide, Incorporated

CONFECTIONERY, like other foods, is affected by atmospheric conditions. Until it reaches a state of equilibrium with the surrounding air it either absorbs or gives off moisture. Closely paralleling the problems of confectionery are those to be found in connection with the manufacture and handling of fruits rich in sugar or to which sugar has been added. Among others might be mentioned dates, prepared coconut, candied citron, and other candied fruits; with all of these the package is of major importance as a means of maintaining quality from manufacturer to consumer.

Ideal storage may be regarded as that created by artificially conditioning the space where finished goods are to be kept to the end that each individual piece be given its own proper conditions of temperature and humidity, admittedly an undertaking of considerable magnitude. Although varieties of confectionery are so numerous as to render impracticable any attempt to provide optimum conditions for the individual variety, yet the problem may be solved in part by providing storage conditions that will meet the requirements of the average of a large number of varied products.

In such storage one will find variations in temperature and humidity, in keeping with whether the survey be made in the winter or the summer and whether it follows a summer week-end during which the brine lines have been shut down. In the instances in which it is customary to work in such artificially conditioned rooms, the total time that doors to the outside are kept open will be the principal factor in determining inside conditions. Although not Utopian, such a room is an advance over the old type of storage in which uncontrolled conditions obtain. Temperatures in the general "cool storage" will vary from 55 to 70 deg. F. Its relative humidity will depend upon and vary with the interchange of outside air and upon such precautions as may have been taken to dehumidify the air as it is drawn into circulation.

A simpler form of storage control consists of regulating the humidity with any of the well known air conditioning systems and holding the temperature down to the lowest point possible without the use of refrigeration. Such a room works well for goods that do not require cold storage. The most common form of storage consists merely of a room that it is set aside for stocking goods until needed for filling orders. Here no attempt is made to regulate temperature or humidity.

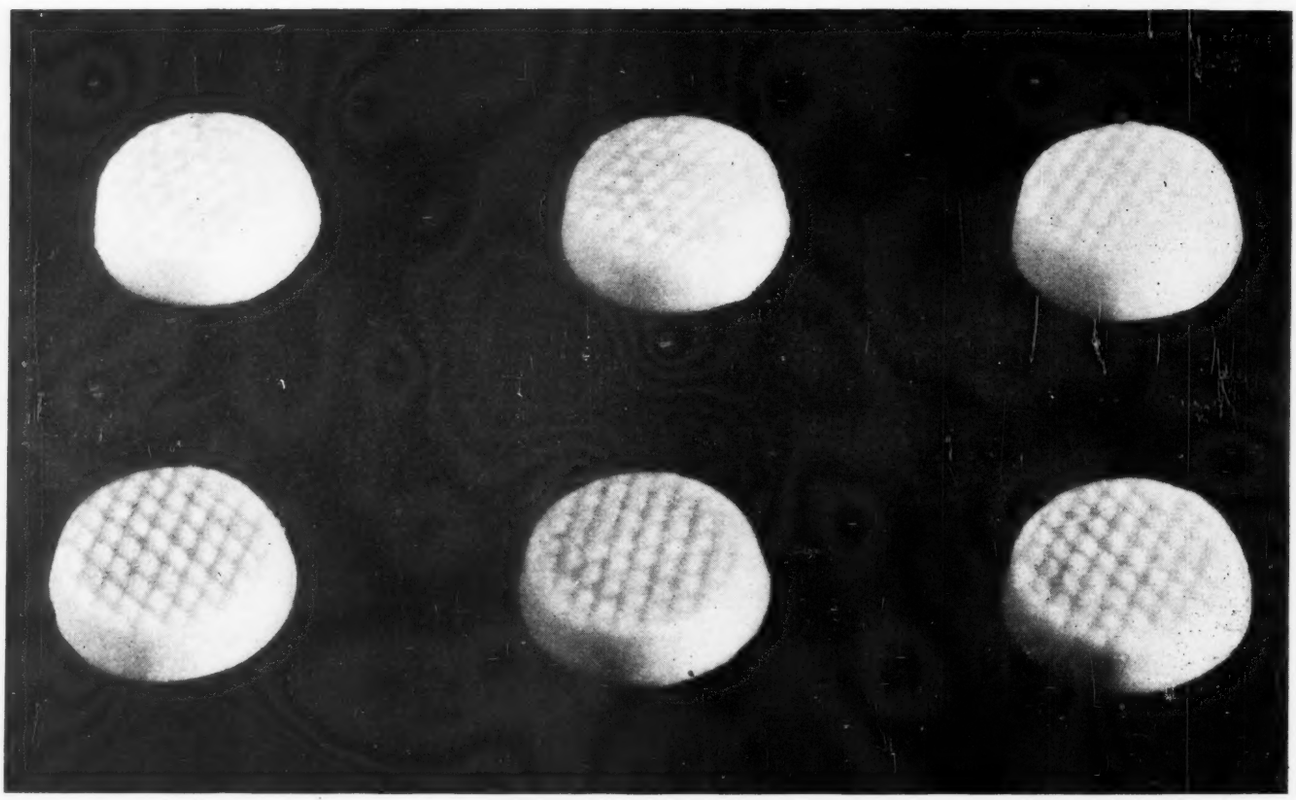
Considering the matter from a somewhat broader angle it is apparent that it makes but little difference as to the conditions under which the manufacturer has stored his products if they are shipped to jobbers and retailers who cannot duplicate those conditions. A piece of chocolate may be stored under ideal conditions only to be shipped to a retailer who places it in a display case with a temperature of 90 deg. F., or in a window whose normal room temperature has been materially augmented by the rays of the sun. Needless to say, no chocolate can stand up under such treatment, nor should its manufacturer be blamed for the subsequent condition of the chocolate.

FUNCTION OF THE CONTAINER

Because it is impossible for the manufacturer to require the jobber and retailer to store his goods under proper conditions he must avail himself of the next best method of protection, and that is the package supplied at the candy factory. The container may be regarded as an individualized form of storage in which products travel to their destination and in which they remain until consumed.

If the container is air-tight and has been closed under a vacuum with a tight seal, the inside conditions will be regulated by the product itself under the conditions of storage. If, however, the closure of this package has been made under normal conditions, by which is meant atmospheric pressure, an equilibrium is soon reached within and no further changes noted unless the temperature is abnormally high. The ordinary container, also called the average package, is usually of the type made from pasteboard or pulpboard and has a loose cover. Such a package is more a matter of convenience in shipping than a protection of the contents against atmospheric conditions for it is neither air-tight nor moisture-proof. The comparatively free interchange of air between the inside and outside of the package leaves the product entirely at the mercy of the elements.

Thus we may divide our packages into three general classifications—the tight seal with vacuum, the tight seal with atmospheric pressure, and the average or ordinary package.



Unretouched Photographs of Fondant Cream Wafers From the Same Batch
Proper packing and storing maintain them in merchantable condition for long periods of time.

Similarly, we may divide confectionery into five general classes, such as, for example, chocolate, hard candy, marshmallow, caramel, and fondant. This is an arbitrary classification which will enable us to consider the general types separately, but the discussion will not cover each class completely. Each type will require special packaging if it is to remain in saleable condition until it reaches the consumer.

Recent work in the Carbohydrate Laboratory at Washington has definitely established that chocolate and chocolate coated goods may be stored under varying conditions, from a few degrees below freezing to within a few degrees of the melting point of cocoa butter. These temperatures are from 22 to about 65 degrees Fahrenheit. When chocolates and chocolate coated goods are removed from cold storage, it is found that progressive steps should be taken to acclimate such goods properly, unless they have been packed into the container under carefully regulated atmospheric conditions and are hermetically sealed before placing in storage.

In the case of the tight sealed package, it is found that no care is necessary in the removal to average or ordinary room temperature for there can be no air interchange, and chocolate goods, *per se,* have little tendency to give off moisture. The coating of chocolate prevents this. In the case of goods that are packed into ordinary containers of the loose cover type, an air interchange with the outside may cause moisture from the outside air to settle on the goods and dissolve sugar from the coating. This will occur when cold goods are placed into a warmer and more humid atmosphere. After inside and outside conditions have reached an equilibrium, the moisture evaporates from the surface of the chocolate and leaves fine sugar crystals which give the characteristic sugar bloom that makes the product unsaleable.

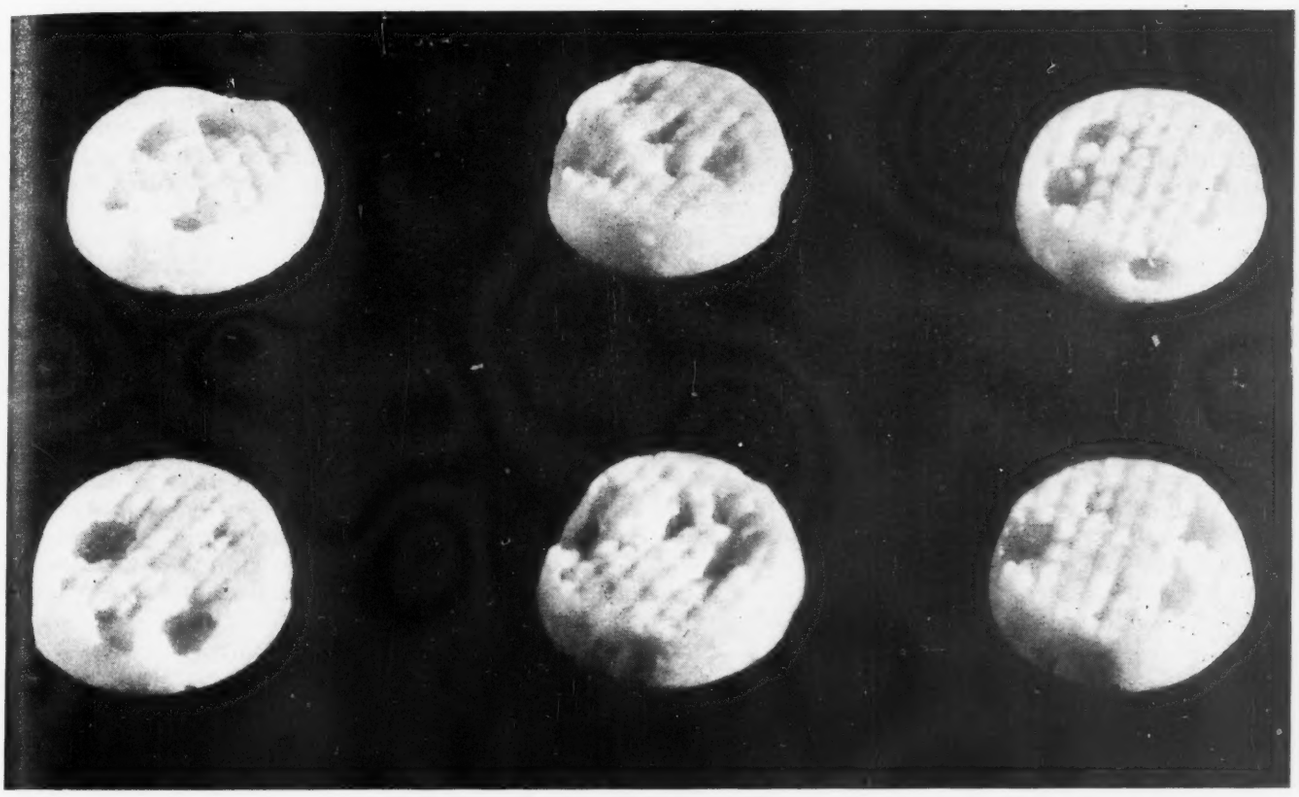
Thus we see that storage of chocolates under commercial conditions is safe if the packages are tight, but where an interchange of air between inside and outside is possible, it is necessary to regulate temperature and humidity. Removal of non-air-tight packages from the average storage condition should be done through successive steps of temperature increase, especially from the condition of very low temperature storage.

It may be expedient to look into the possibility of packaging all chocolate goods in safer packages.

In the handling of hard candy it will be found that both corn syrup and invert sugar have the tendency to absorb moisture at a rate that is governed by atmospheric conditions. Equipment manufacturers advertise cookers which will remove moisture from the batch down to within a fraction of one per cent, and it is a known fact that the dryer the finished batch is, the longer and the better the gloss and finish will remain, always assuming that the formula used has been properly balanced to prevent graining. It is folly to spend time and money in making a fine product if it is to be put into any kind of a container whether suitable or not but, on the other hand, it is doubtful whether the vacuum package offers enough advantage over the tight seal under normal conditions to make the extra cost worth while. The last statement is made with the assumption that the packaging has been done under well regulated conditions and not under the haphazard atmospheric conditions of non-controlled floors.

Friction caps, screw caps, or caps of the clamp type will diminish interchange of air with the outside if they fit properly and any minute leakage which occurs will affect the product only by normal expansion and contraction under varying storage conditions.

From a sales standpoint the package should be transparent, but unfortunately light affects certified colors



Improper Packing and Storing Often Causes a Sweating
This may dissolve the surface from existing air holes, although without loss of substance, but with disastrous results.

in time. On the other hand, a metal package will keep light out and preserve brilliancy, but the sales appeal of attractive colors and shapes in this type of candy is thus lost. Regardless of whether we adhere to the metal package or the glass jar school, the one fact to keep in mind is that air interchange with the outside must be eliminated, or kept down to a minimum, in order to extend shelf life in the store.

Marshmallow goods are made in both hard and soft varieties. The harder variety will be affected by temperature to such an extent that cold winter weather will cause it to become as brittle as glass, while hot and humid weather will make it as soft as a wet rag. The soft variety of marshmallow has a tendency to lose moisture while the hard variety is little affected by average conditions of storage but tends to absorb moisture rather than give it off. Products in which marshmallow has been used will be found to act similarly if it is the predominant ingredient.

Two different packaging problems are apparent when we consider these two types of goods and in the case of the hard variety, an ordinary package is satisfactory if properly wrapped after packing. Only excessive temperature and humidity will cause it to absorb moisture and very cold weather is required to make it hard and brittle. A properly balanced formula will render the proper packaging of this product more easy of solution, but the container cannot make up for deficiencies of the product itself. The soft variety of marshmallow requires a moderately tight package which will cut down air interchange and keep the goods in condition, but it must not be too tight. When an air-tight package is used and the moisture content is high, goods of this sort will sweat and stick together under conditions of storage where high temperature prevails.

The problem of packaging caramel, kisses, and toffee is not of serious moment unless the goods are to be shipped through variable climatic conditions. While these goods are sticky in character and possess variable moisture content, which as a rule is quite high, each individual piece is usually wrapped in wax paper. This automatically relieves the package of that portion of its responsibility having to do with the restraint of moisture interchange.

If storage for long periods of time is contemplated or shipment is to be made through variable climatic conditions, an air-tight container is not only desirable but is an actual necessity. Butter and vegetable fats are often used in such products and they will have a tendency to go rancid if left in contact with the air. This indicates the use of a vacuum package but it must not be forgotten that this is a product selling for little money and, as the bulk caused by the individual wrapping causes an increase in package cost, due to increased volume, haste should be made slowly, and perhaps a quick turnover at a lower profit would be more profitable in the long run if an average package were used. Certain toffees and butterscotch are exceptions to this rule, and here the price is sufficiently high to permit more money to be spent on containers. Metal containers with tight fitting covers have usually found favor for such products.

Fondant and fondant products offer a problem all their own. In these products is a high cooked sugar syrup containing varying amounts of corn syrup and invert sugar which have been cooled below saturation point, and the excess sugars crystallized by rapid agitation. Syrup density in such a product will have its effect upon keeping qualities. This type of goods is nothing more than a mixture of color and flavor, along with sugar crystals and saturated syrup. The point of saturation for the syrup will be governed by temperature and the solubility of each individual component.

It is necessary to assume the existence of a properly

balanced formula for fondant for the purpose of this discussion whether the fondant is to be used for dipping or casting. Such a formula will carry amounts of water of from ten to fifteen per cent and the product will give off moisture if stored under high temperature conditions. Under these circumstances an airtight package will retain all the moisture given off, later permitting it to condense on the lining and on the goods themselves. The result is a sweat and by it sugar is dissolved. The syrup thus formed soaks slowly into each piece and dissolves off the surface of any air holes which may exist in the cast piece. Little reservoirs of syrup are thus formed where the air hole previously existed, and the syrup soaks into the goods, leaching out color as it goes. The net result is candy "small-pox" or "measles" and produces an unsaleable product. This form of trouble has often been erroneously attributed to bacterial spoilage, for undoubtedly bacteria will be found where the outside syrup density is low enough to permit their propagation. But the initial fault was in the type of package used and improper temperature of the storage room.

Fondant goods must be allowed to "breathe." They must be kept under regulated temperature conditions. In no case should vacuum or air-tight packages be used for goods that are intended to be sent into average trade conditions. Fondant goods packages must have breathing ability but, on the other hand, the closure must be sufficiently tight to prevent undue loss of moisture and

Under the foregoing classifications of confectionery it has been seen that the package is, or should be, an individualized storehouse where the goods may be kept under conditions closely approximating the optimum until required for use by the consumer. The convenience of gathering up several loose pieces and wrapping in the old fashioned brown paper has slowly given way to the more modern methods of handling, and the present container must preserve, as well as be a convenience, or it does not fully serve its purpose in these days of intensive competition.

Shelf-life, change in composition with age, and proper packaging are so intimately tied up that one cannot be considered without touching upon the other two, and much research and plant-sized experimenting will be required before the proper package and formula to go with it may be linked together in the production of the best goods at the least cost.

A New Laboratory of the National Canners Association

By J. Russell Esty

THE National Canners Association maintains three research laboratories. One, established in 1913 is located at the association headquarters in Washington, D. C.; another was established in 1919 in Seattle, primarily to serve the salmon canners; the third, established in the summer of 1926 in San Francisco, is known as the Western Branch Laboratories and serves the Pacific Coast, the inter-mountain states, and the Hawaiian Islands. In carrying on its chemical, bacteriological, technological, and physiological investigations, the National Canners Association has also collaborated with other educational and scientific institutions and Government agencies conducting related research. The total cost of the work of the association's laboratories since their organization has been approximately one million dollars. More than $400,000 additional has been contributed to several universities to defray the cost of physiological investigations, particularly vitamin and food poisoning studies.

The main function of the Western Branch Laboratories, as well as those in Washington and Seattle, is to conduct investigations into the fundamental principles governing the art of canning, with the view of improving quality and of determining causes of spoilage. Part of the time of the laboratory staff is also devoted to giving service to association members. This service consists largely in a study of the problems affecting the individual canner but the nature of these problems has been so varied that the information obtained and the experience gained has been of general value to the industry. In this work the laboratory has come into close contact with the canners and their products. These laboratories also collaborated actively with the Medical Department of the University of California and the California State Department of Health in the botulism investigations conducted by those institutions. This aspect of the work of the laboratories is under the direction of Dr. K. F. Meyer, who has charge of the work in the other institutions mentioned.

These laboratories are located in a three-story and basement building at 322 Battery Street, San Francisco. They are well supplied with chemical and bacteriological apparatus. The canning room is equipped with the essential machinery for the canning of small lots on an experimental scale. Three large built-in incubators, two in the basement and one on the third floor, furnish over 1,200 cu.ft. of space suitable for the incubation of a large number of cans at any desired temperature. These incubators are electrically heated and controlled and equipped with recording thermometers to give a continuous record of the temperatures maintained.

At the present time seven research workers are engaged in two major investigations, namely, a study of the causes of and means of prevention of hydrogen springers and perforations in canned fruits, and bacteriological studies to determine proper sterilizing procedures for various food products.

During the two years of operation these laboratories have handled and rendered confidential reports on 700 jobs for association members. These have included the examination of over 70 different food products and also certain materials used in the canning industry, such as label paste, paints, cements, sugar, and water. They may be roughly classified as follows:

1. Chemical analysis, involving special tests, such as tests for the presence of foreign metals and coloring matter and analysis of water, salt, sugar, oil, acidity determinations, and gas analysis.

2. Requests for information on the details of packing and processing of different foods.

3. Bacteriological studies to determine the cause of spoilage, whether due to under-sterilization or to faulty closure of the can.

4. Sterility tests to determine whether different batches of food have been properly sterilized.

5. Examination of hydrogen swells and perforated cans. (In these cases the action of fruit acids on the metal of the container has been accompanied by the

evolution of hydrogen gas, which gradually reduces the vacuum of the can and builds up sufficient pressure to bulge the ends. The contents are sterile and usually are normal in appearance.)

6. Check analysis of tomato and tomato products, with special reference to the mold, yeast, and bacterial content, and determinations of specific gravity and total solids.

7. Study of causes of discoloration and abnormal flavors in canned foods.

8. Studies with reference to the relative resistance to corrosion of different metals or alloys used in the manufacture of cannery equipment.

The following is a brief statement concerning the research work and the more important investigations which have been studied here.

Springer-Perforation Problem

The packer of certain fruits and berries has experienced to a greater or less extent losses due to the formation of hydrogen springers and swells or to perforations. For some time this has been receiving the attention of many investigators and although the service value of the container has been prolonged by increasing the weight of tin coating, yet no permanent relief has so far been obtained.

This subject is being attacked by this laboratory from the standpoint of the chemical changes involved during the development of springers and perforations, as well as a study of the effect of certain variations in the methods of packing. During the past year's study of this problem, Dr. G. S. Bohart, assisted by Dr. E. F. Cornell and Mr. P. C. Wilbur, has chiefly concentrated his attention on the examination of experimental packs of cherries and berries put up in the Pacific Northwest during the 1926 and 1927 seasons.

The method of observation of the development of hydrogen springers in these products has been to some extent a departure from that ordinarily used. It is the usual practice to count the number of springers (a can at least one end of which has sprung out) that have developed by a casual examination of the pack at regular intervals. In this work use is made of a method whereby the approximate rate of loss of vacuum may be determined. If an external vacuum be applied to th end of a can, it is obvious that the end will flip out when the external vacuum is just slightly in excess of the vacuum on the inside of the can, plus the resistance offered by the inherent rigidity of the tinplate. For a given can at a given temperature the vacuum necessary to cause the end to flip out could be determined on an accurately calibrated vacuum gage inserted in the line. It would then be possible to follow the rate of loss of vacuum on a given can by determining the "flip vacuum" value before storage and at regular intervals during the storage until the can becomes a springer or perforates. The difference between the values obtained at the two different times represents the loss of vacuum during that interval. The loss of vacuum occurring during intervals of a month each has been determined on each can in the experimental packs and from the results obtained certain relationships were found. Based upon the information obtained, another set of experimental packs of fruit were put up during the last season, which packs are being stored at constant temperatures. Observations on the loss of vacuum of each can are being made at regular intervals.

In connection with these studies a method has been developed whereby cans with a low vacuum may be separated from those with a high vacuum. The principle involved is not new to the canning industry, but merely represents a refinement of the method that has heretofore been used successfully in isolated instances.

The Bacteriological Department, under the direction of Dr. K. F. Meyer, has conducted detailed studies to determine appropriate cooks upon which regulations can be formulated governing the packing and processing of certain vegetable, fruit and meat products. Special attention has been given the processing of spinach, asparagus, and artichokes to determine the efficiency of processes in present use. This program has involved the incubation of a large number of commercially packed cans and the examination of several experimental packs. The laboratory also handles the control work for the California State Department of Health in connection with the Inspection Service. This service has many times enabled the inspectors to release batches of goods which were temporarily quarantined on account of irregularities in the canning procedures. It also gives valuable information on the effectiveness of the processes being used in California and provides additional protection to the industry. These studies have involved the determination of the thermal death times of many of the various spoilage organisms in different juices, measurements to determine the rate at which heat penetrates to the center of the product in different sized cans, and acidity studies. A bacteriological examination of the spoiled material from under-sterilized cans has furnished valuable material to determine the significance of various organisms as causative spoilage agents in different food products. An attempt is now being made to develop simple means of identification whereby the source of these organisms may be readily established. This work is preliminary to extensive plant surveys to determine the sources of contamination and devise means for their elimination.

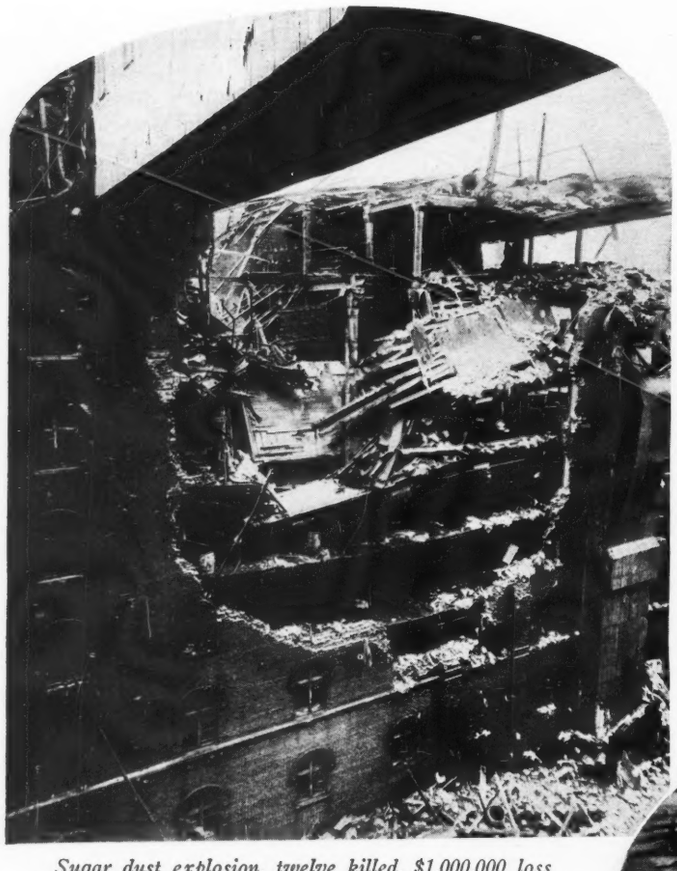
Pineapple: An extensive investigation on the quality of canned pineapple after it has been stored at different temperatures for varying lengths of time is in progress. Representatives of the pineapple canners in San Francisco have assisted in this work. It is already evident that the storage temperature is an important factor.

Zinc: The zinc content of canned and fresh fruits has been investigated and it has been found that traces of zinc in the finished product may be due to that present in the fresh fruits themselves, whereas a relatively high zinc content may indicate contamination brought about through contact with certain equipment in the cannery. When the latter is found to be the case, the equipment causing this contamination is eliminated. However, the raw fruits themselves usually contain enough zinc to account for that present in cans of the finished product.

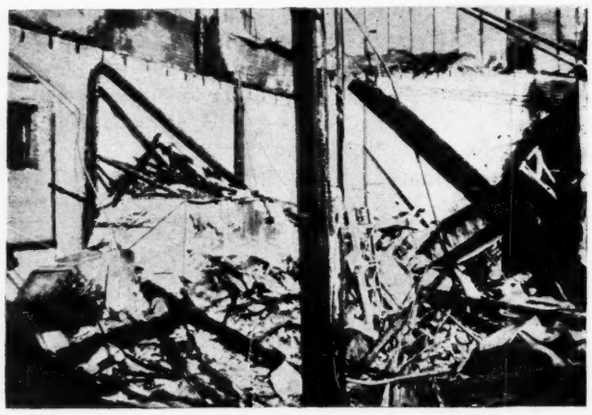
Tomato Products: During the 1926 season the laboratory analyzed for the State Department of Health samples of tomato puree, sauce, and paste packed in each plant of every canner who operated in California, as well as a large number of check samples for association members. A study of the methods for the determination of the specific gravity of tomato puree has also been made to establish a standard method for the control of Western tomato products.

The foregoing statement is fragmentary and necessarily incomplete but it is hoped that it will give some idea of the nature and scope of the activities of these laboratories. The fact that during the first seven months of this year 26 per cent more jobs were handled than during the same period in 1927 is evidence that increasing reliance is being placed in the work of these laboratories.

Typical Dust Explosion Catastrophes



Sugar dust explosion, twelve killed, $1,000,000 loss

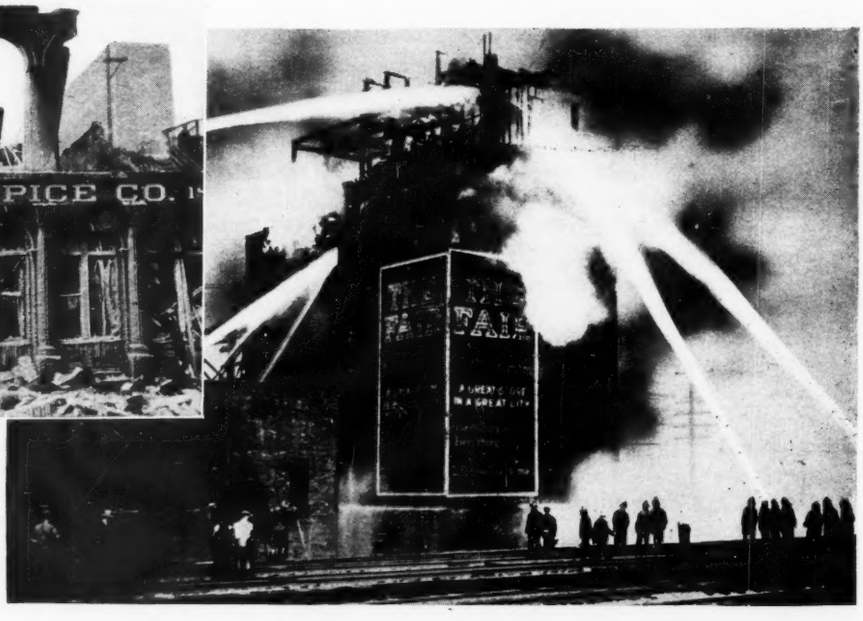


Chocolate dust explosion from a fan in the dust collecting system. Three men killed, loss $750,000

Result of an explosion of powdered milk dust

First recorded instance of an explosion of cotton seed meal. This total loss was due to a small piece of metal in a grinder

ABOVE—*During this fire, spice dust exploded and killed four firemen*



Firemen fighting the fire resulting from an explosion of grain dust—RIGHT

Minimizing the

DUST EXPLOSION HAZARD

By DAVID J. PRICE

Engineer in Charge, Chemical Engineering Division,
Bureau of Chemistry and Soils, U. S. Department of Agriculture

EARLY attention to dust explosions in industrial plants began as the result of dust explosions in one of our basic food industries—flour milling. The explosion in the Washburn Flour Mills in Minneapolis on May 2, 1878 (*Dust Explosions,* Price and Brown, Nat. Fire Prot. Assn., Boston, 1922), made a definite contribution to our knowledge of the subject. In the early days of flour milling, the flour dust was blown into a large room and removed by the workmen at stated periods. This necessitated the use of open lights, which afforded a ready source of ignition. As a result of the explosion in the Washburn Flour Mills the old dust or "stive" room was eliminated, and efficient mechanical methods of dust collection were introduced.

Developments following the Minneapolis explosion in 1878 practically revolutionized the flour milling industry. The records indicate that the efficient methods adopted by this industry have resulted in reducing the dust explosion hazard and in curtailing explosion losses. The recognition of the principle that suspended dust and an ignition source constitute a dust explosion hazard stimulated the flour milling industry in the designing of effective dust collecting equipment which has been consistently used in flour milling operations ever since.

EFFECT OF NEW MANUFACTURING PROCESSES

Although our attention was called in a very definite way fifty years ago to the dust explosion hazard, we are still faced today with this important, well recognized industrial problem. The expansion of the food industries, the utilization of by-products and waste materials, the introduction of new methods and processes with correspondingly increased production, and new types and sources of ignition have produced additional hazards in some of our newer types of industries. The increased use of spray drying equipment in the food industries has introduced new ignition sources, requiring that care should be exercised in the installation of drier equipment of all types, where food products are handled in powdered form.

EXTENT OF DUST EXPLOSION HAZARD

Research studies of the Bureau of Chemistry and Soils have demonstrated that when mixed with air in proper proportions combustible dust of almost all types can be ignited with explosive violence. There are at least 28,000 industrial plants in the United States subject to the hazard of dust explosions, in which practically all food industries are included. These plants employ approximately 1,324,000 people and annually manufacture products valued at more than 10,000,000,000 dollars.

In recent years dust explosions have occurred in many industries where they had not previously taken place so that the number of industrial plants where the dust explosion hazard exists appears to be constantly increasing. In addition to the explosions in what might be termed grain handling and milling operations, there have been explosions of starch dust, sugar dust, powdered milk dust, chocolate dust, spice dusts, rice dust, cottonseed meal dust, wood dust, powdered rubber dust, paper dust, fertilizer dust, sulphur dust, zinc dust, magnesium powder, aluminum dust, pyroxylin lacquer dust, cork dust, dye materials, coal tar pitch dust, leather dust, and many others.

WORK OF DUST EXPLOSION HAZARDS COMMITTEE

In the work of dust explosion prevention, the Bureau of Chemistry and Soils enjoys close co-operation with the food industries, State commissions, insurance organizations, underwriting agencies, and many other interested associations. This splendid co-operation makes possible prompt application of the control and preventive methods developed by the Bureau engineers. One of the most valuable contacts is with the National Fire Protection Association through the Dust Explosion Hazards Committee, a committee charged with the preparation of measures for the prevention and control of dust explosions in industrial plants. This committee, composed of representatives from the various industries directly concerned and from insurance and safety organizations, State and Federal officials, also construction engineers and equipment engineers, works under the leadership of the Chemical Engineering Division of the Bureau of Chemistry and Soils, the engineer in charge of the dust explosion studies in the Bureau having been chairman of the committee since its origin in 1922. The committee has already prepared (*Safety Codes for the Prevention of Dust Explosions,* U. S. Dept. Labor Bull. 433), measures for dust explosion control and prevention in the following industries: (1) Flour and feed mills, (2) Sugar and cocoa pulverizing systems, (3) Terminal grain elevators, (4) Pulverized fuel systems, and (5) Starch factories. These safety codes have been approved by the National Fire Protection Association and have been adopted by the National Board of Fire Underwriters. They have also been approved as "American Standard" by the American Engineering Standards Committee. The committee is endeavoring to prepare similar regulations

for dust explosion prevention in other industries where the loss of life and property has been extensive.

Although the research studies in the Bureau of Chemistry and Soils have been identified particularly with grain milling and handling industries, the Bureau has been frequently called upon for assistance by many other industries in which dust explosions have occurred (*Chem. and Met. Eng.*, Vol. 35, No. 3, Mar., 1928, pp. 150-152). The co-operation with the starch industry is a splendid example of the desire on the part of an industry where the dust explosion hazard is well recognized to develop control measures.

The dust explosion hazard in starch factories exists in three distinct departments: (1) In the corn receiving and storage departments in the form of grain elevator dusts, (2) In the dust arising from the milling and storage of the so-called gluten feed, and (3) From the presence of starch dust in drying, grinding, packing, and similar operations.

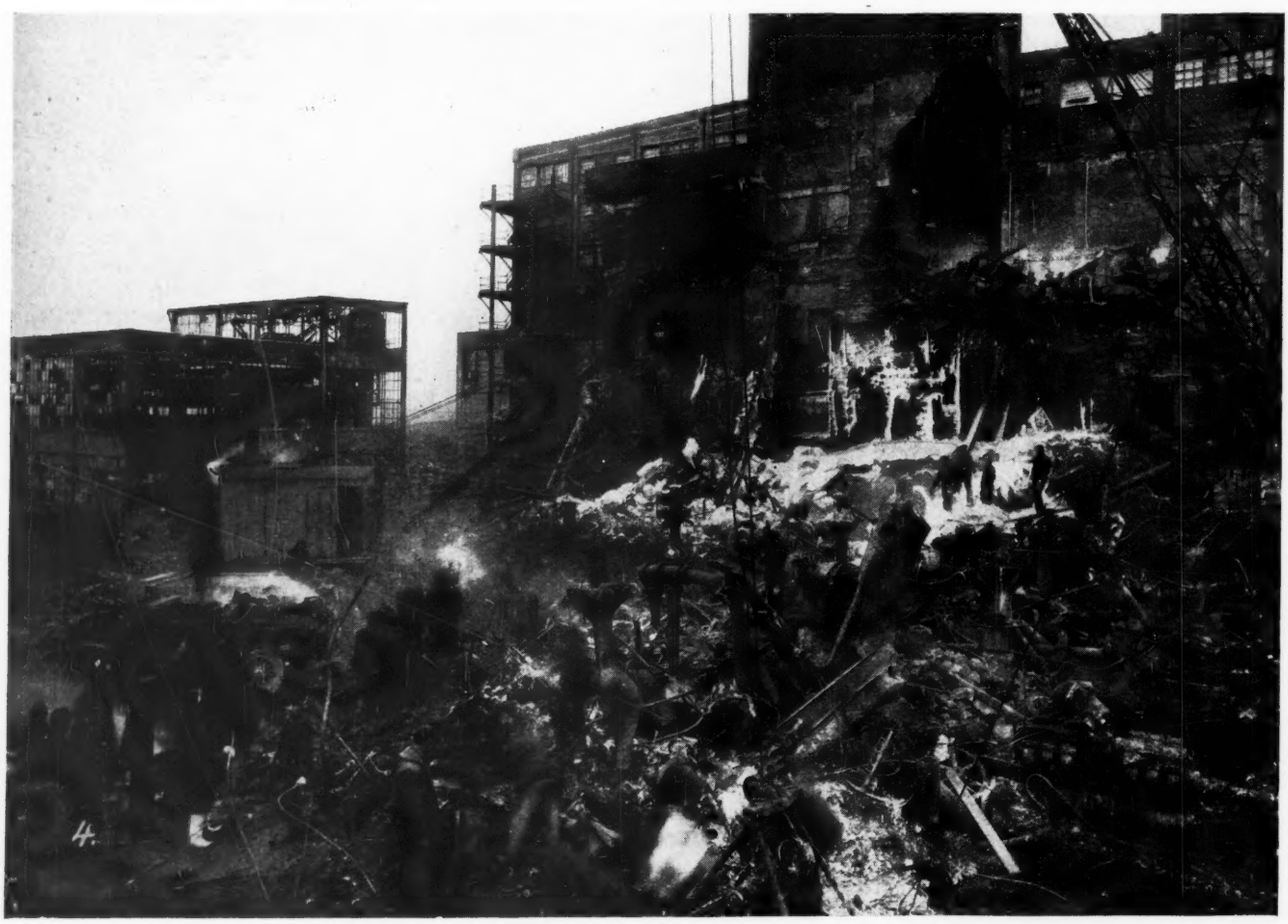
The measures developed for the prevention of dust explosions in grain elevators cover the first hazard referred to, the second is provided for in the code for flour and feed mills. The control measures for starch factories, therefore, relate specifically to the hazard in the third department, namely, in the handling of dried starch. This hazard is present at the starch drying kilns and in all processes involving the handling of the starch from the kilns up to and including the packing. It is now generally accepted that any kind of starch dry enough to float in air is dry enough to contribute to an explosion, even though the department may be one in which the air is humid.

The control measures recommended cover: (1) Construction and arrangement of buildings in which starch drying is conducted, (2) Construction and arrangement of kilns, (3) Dry starch grinding and grading, (4) Pearl and powdered starch bulk packing, (5) Lump starch cooking, pressing, grading, and packing, (6) Control and removal of suspended dust, (7) Removal of static dust, (8) Prevention of ignition, (9) Mechanical precaution, and (10) Housekeeping.

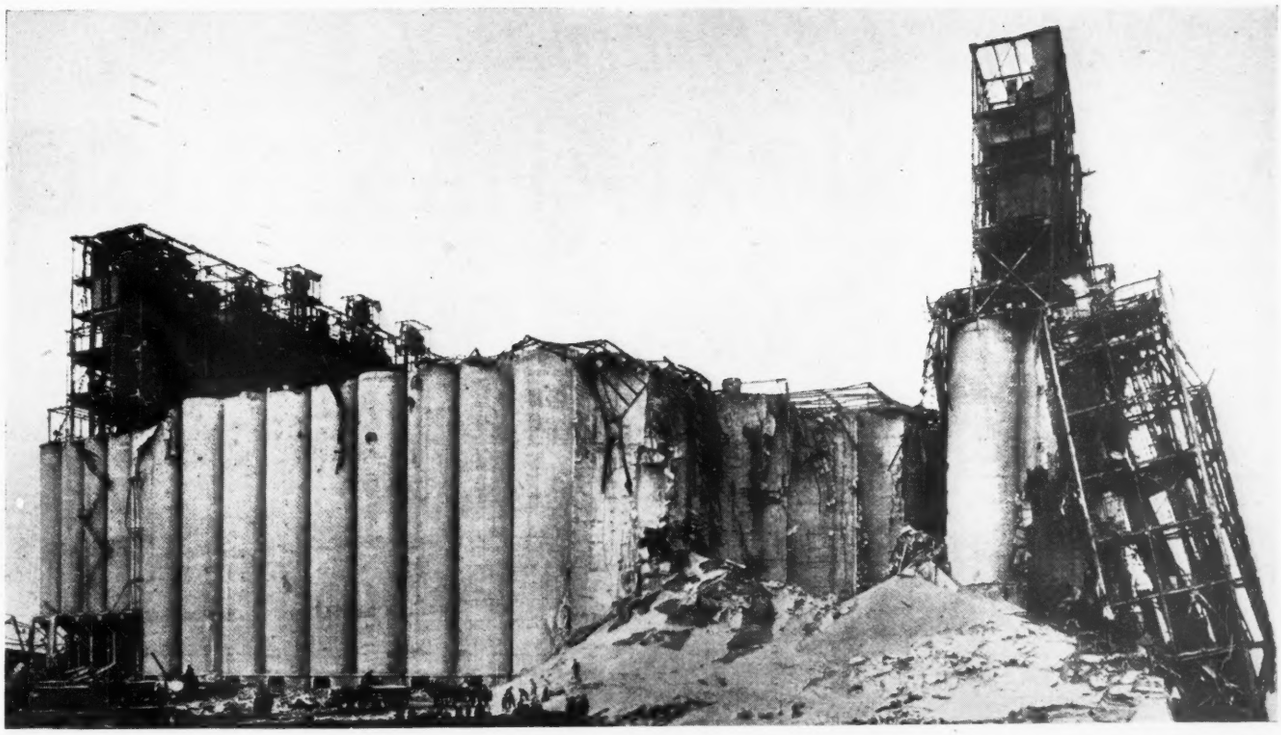
Causes of Dust Explosions

The dust explosion hazard in the food industries exists in practically all the manufacturing processes. A large number of explosions have been associated with conditioning apparatus, such as grinders, crushers, rolls, and pulverizing equipment. Explosions may originate in conveyors, elevators, loading and unloading apparatus, and in other kinds of handling and conveying equipment. In some instances explosions have occurred in the operation of separators, dust collectors, sifters, and separating equipment of other types.

It appears from extensive studies that the use of open flames and lanterns, and what might be termed the more "common" causes are not so prominent among the causes of dust explosions in industrial plants as they once were. It is evident that the educational work conducted in recent



A Starch Dust Explosion in Which 42 Men Were Killed and 22 Were Injured
The force of the explosion is indicated by the ruins of the three story brick building which formerly stood in the open space in the foreground.



Effects of an Explosion in a 10,000,000-Bushel Grain Elevator
This was regarded as a model both for construction and mechanical equipment. Six men were killed and the property and grain damage was approximately $4,000,000. Note the damage to reinforced concrete and steel construction.

years has been instrumental in impressing the dust explosion hazard on plant officials and employees and that more attention is being given to the control of causes of this type. The installation of new mechanical equipment and electrical appliances, however, has introduced additional causes, and it is interesting to observe what a prominent part *electricity* has played in some of our recent disastrous explosions.

Static electricity also plays a prominent part in industrial plant dust explosion disasters. The possibility of the electrification of dust clouds in mixing apparatus and dust collection and transport systems has been very definitely indicated. This is an important field for further research in order that effective control measures may be developed.

Control Measures

It is essential in the introduction of new processes in which mechanical equipment of special types is used that attention be given to the adoption of control measures for the dust explosion hazard. This matter should be fully considered in the design of the equipment and not delayed until a costly explosion has demonstrated the need of control measures. Advantage should be taken of the research work already carried on and practical application made of methods that have been proved to be successful.

The explosion hazard in conditioning apparatus, particularly grinding machines of the "attrition" type, has been eliminated by the use of inert gas. As a result of extensive experimental work by the Bureau of Chemistry and Soils and observations made during actual operation of inert gas systems in industrial plants, the value of inert gas as a means of preventing dust explosions has been so well demonstrated that its use should be seriously considered wherever an explosion hazard exists which cannot be controlled through the elimination of the dust cloud on the source of ignition. The use of inert gas is particularly recommended in grinding, bolting, or any phase of a manufacturing process where an explosive dust is produced or handled in an enclosed piece of equipment. This work in the Bureau of Chemistry and Soils, which was carried on by Hylton R. Brown, has recently been published as Department of Agriculture Technical Bulletin No. 74 entitled *The Value of Inert Gas as a Preventive of Dust Explosions in Grinding Equipment.*

It will not be possible to enter into a detailed summary of control measures for all possible causes of dust explosions in food industries. This article is intended merely to indicate the importance of giving attention to this industrial problem and utilizing the data available. Considerable could be written regarding plant construction in its relation both to the origin and extent of explosions. The value of certain types of construction, particularly large window glass area for venting, has been well illustrated. It is hoped that a later article will afford the opportunity of dealing more fully with these specific phases of the subject.

Economic Value of Dust Explosion Prevention

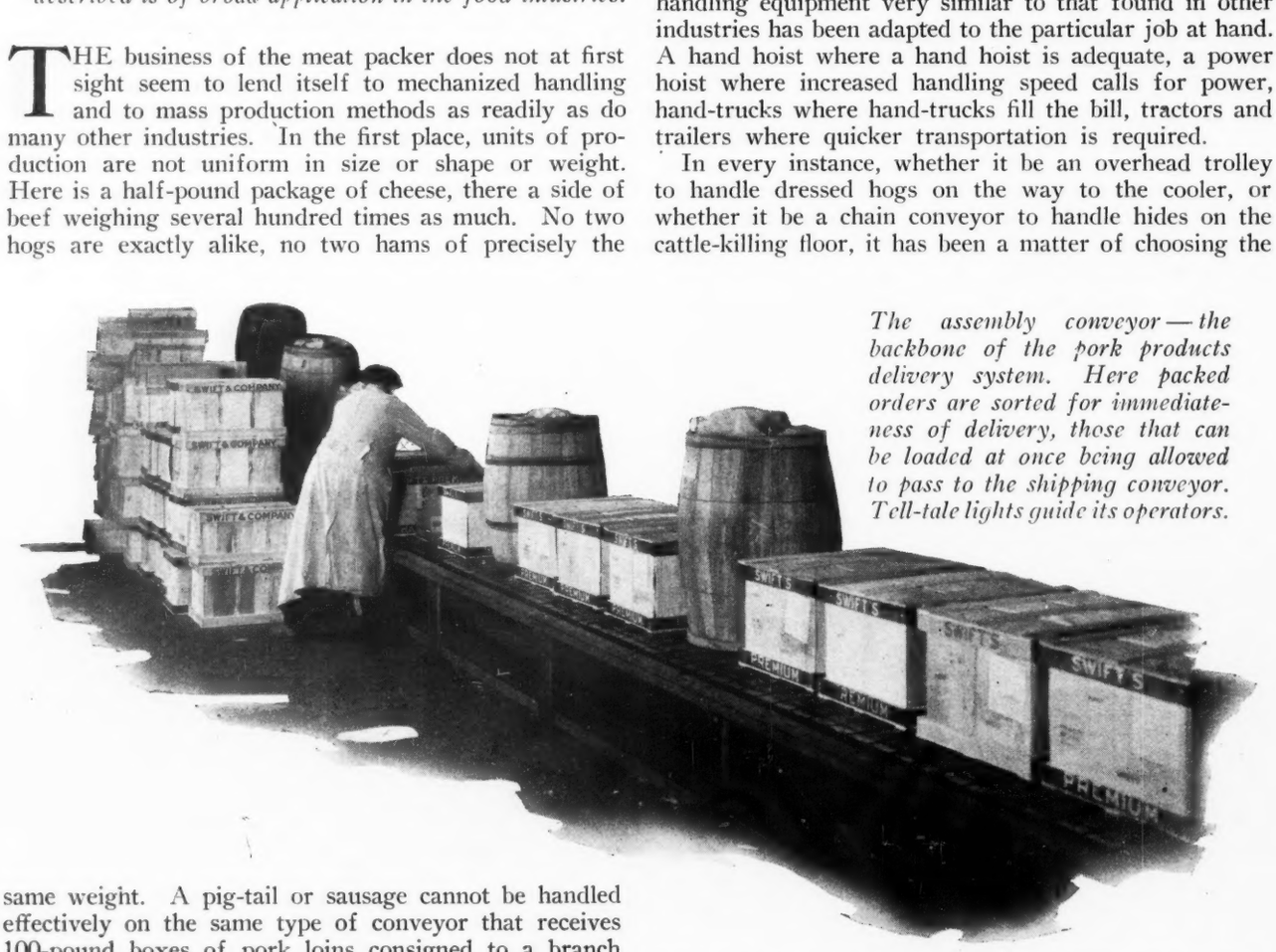
The saving of life, property, and food stuffs is vitally related to the conservation of national resources. Although we have made progress in obtaining scientific data on the causes of dust explosions in certain types of industrial plants and in the developmet of methods for their control and prevention, it is apparent that this problem is extending into many new food industries in which the hazard is now being definitely recognized. The Chemical Engineering Division of the Bureau of Chemistry and Soils is very desirous of continuing to co-operate with the industries and other interested agencies in obtaining further information regarding the dust explosion problem, and of rendering any possible assistance in the development and application of effective methods of prevention and control.

Co-Ordinated
MECHANICAL HANDLING
As a Source of Profit

By R. C. SIMS
Superintendent, Chicago Plant
Swift & Company

EDITOR'S NOTE: *Food manufacturers will find substantial economies in the use of carefully synchronized conveying systems. The following description, based upon a coyprighted article appearing in the August, 1928, number of* FACTORY AND INDUSTRIAL MANAGEMENT, *shows how the material-handling problems have been solved in the meat packing industry. The system described is of broad application in the food inlustries.*

THE business of the meat packer does not at first sight seem to lend itself to mechanized handling and to mass production methods as readily as do many other industries. In the first place, units of production are not uniform in size or shape or weight. Here is a half-pound package of cheese, there a side of beef weighing several hundred times as much. No two hogs are exactly alike, no two hams of precisely the same weight. A pig-tail or sausage cannot be handled effectively on the same type of conveyor that receives 100-pound boxes of pork loins consigned to a branch house.



The assembly conveyor — the backbone of the pork products delivery system. Here packed orders are sorted for immediateness of delivery, those that can be loaded at once being allowed to pass to the shipping conveyor. Tell-tale lights guide its operators.

Far from being a progressive assembly job, meat packing resolves itself into quite the opposite sort of thing. Starting with the live hog, the packer ends up with spare ribs, leaf lard and sliced bacon, and yet, paradoxically enough, he works in pretty much the same way and with exactly the same handling tools as the automotive manufacturer who begins with iron ore and balloon tires and winds up with four-door sedans and convertible coupés. In every corner of our plant—and it covers 57 acres—handling equipment very similar to that found in other industries has been adapted to the particular job at hand. A hand hoist where a hand hoist is adequate, a power hoist where increased handling speed calls for power, hand-trucks where hand-trucks fill the bill, tractors and trailers where quicker transportation is required.

In every instance, whether it be an overhead trolley to handle dressed hogs on the way to the cooler, or whether it be a chain conveyor to handle hides on the cattle-killing floor, it has been a matter of choosing the right equipment to fit the job—the equipment that would cut manual handling to the irreducible minimum—the equipment that would soonest return first cost in time and energy saved.

But unfortunately, choosing the right equipment is only a little more than half the battle. A slat conveyor may be the type of equipment needed to handle packed orders destined for the eleven o'clock local freight, but

to what avail if the conveyor is not tied up properly to the smokehouse or to the other departments in the fresh pork division which have packed products ready to ship? A belt conveyor does a nice job of carrying sliced bacon from the packers to the cartoning and carton-wrapping machines, but are we to stop there? How are we going to get the cartons of sliced bacon down to the main shipping conveyor located on another floor level?

Again, we may devise ways and means of tying up all these departments to the shipping conveyor, but when the conveyor gets loaded with cartons of bacon and boxes of fresh pork, how are we to tie it up in turn to the freight car waiting down on the shipping dock? How to be sure that a box of hams packed at half-past ten in the morning will be aboard the local freight when it moves out, as it always does, on the stroke of eleven?

Our problem, then, is not so much choosing the right equipment for the right job as it is tying the system together into an articulated whole. It is rather the teaming of equipment designed to handle products of varying shapes, sizes and weights so that there will be no gaping holes—so that there will be the minimum of manual handling from the time the hog is killed to the time, cut into the various parts which the trade demands, it reaches the refrigerating cars.

This we have managed to do. At least, nothing marked for local freight is left stranded on the main shipping conveyor in the fresh pork department when eleven o'clock rolls around, and every carton of sliced bacon has found its place in the proper car without being handled and rehandled a dozen times. A chute here, a conveyor there, a tractor, a trailer—all tied together into a system that functions swiftly, easily, economically. We have, in short, a handling system that works, one that is doing its share toward making possible the profits we have been able to show from year to year.

Throughout the various departments much use is made of endless chain conveyors, slat conveyors, hoists both power-driven and manually-operated for the occasional job, trolley rails for the utilization of gravity and for horizontal travel, chutes, and elevators. About the only purely manual handling operation still to be found in the whole packing process, and one that seems to resist stubbornly the efforts of the engineer, is in the curing of hams where the workman is personally responsible for the "overhauling" of the partially cured ham at the expiration of 5, 15, and 30 days.

Belt conveyors are also employed in the packing department where the various cuts are wrapped. Sorted by averages into bins, they are then packed in boxes and pushed down a roller conveyor to a chute leading to the assembly conveyor on the lower cooling floor.

The assembly conveyor for packed orders and the shipping conveyor on the tramway level form the backbone of the mechanical handling system in the pork-packing department, and provide a perfect example of the way in which we have teamed equipment. The assembly conveyor, which is the conventional type of slat conveyor, is fed by chutes from the trimming floor, from fresh pork packing, and from smokehouse packing. It runs to the end of the floor where a roller conveyor without power connects it to the shipping conveyor on the floor above. Packed boxes and barrels reach the assembly conveyor by way of the three chutes; if marked for cars not yet "set" at the loading docks, they are taken off temporarily and piled on the floor close to the conveyor. In other words, only packed orders that can be carried at once to the cars are allowed to pass from the assembly conveyor to the companion equipment on the tramway level.

To regulate the flow of orders from the third to the fourth floors, a tell-tale light is located near the end of the assembly conveyor. When the power is shut off on the floor above, the light goes out and the men stop loading. In this way there is no congestion on the shipping conveyor, and orders are handled quickly and easily as they come along.

Teamed with the assembly conveyor is the main shipping conveyor on the floor above. Manned ordinarily by nine men, five cars are assigned to each man, and as crates or boxes marked for his cars come along, he takes them off and loads them on trailers spotted beside the conveyor. At the beginning of the conveyor is a spiral chute from the sliced bacon room on the sixth floor, which completes the tie-up between the two conveyors and the various departments in the pork division from which packed products are shipped. An idea of the savings made possible by the conveyors and the connecting

The shipping conveyor, on the tramway level, is teamed with the assembly conveyor. Here are loaded the trailers that are rapidly made up into tractor-drawn trains

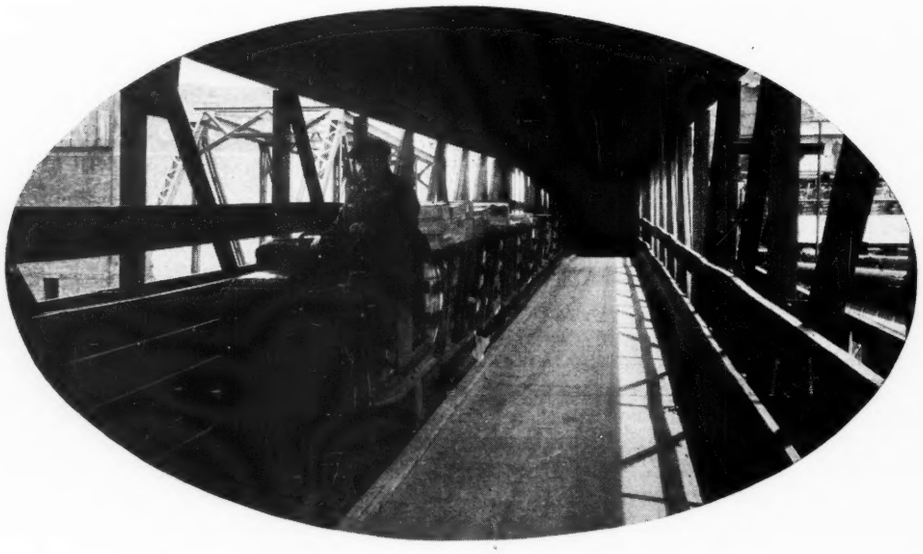
chutes may be gleaned from the fact that 18 men handle these packed orders in place of the 50 formerly needed.

From the shipping conveyor, tractors pull the loaded trailers over the tramway to the refrigerating cars—the final link in the pork division handling chain. And in some respects the most important link, for the tramway and tractor-trains have done so much to speed up handling operations that it is now possible to receive an order at noon and have packed products from a dozen departments assembled and loaded two or three hours later.

Anywhere from 12 to 17 of these tractors and about 1,300 trailers are in daily use on the tramway, and handle packed products not only from the pork division, but also from various other manufacturing departments scattered throughout the plant. A foreman and three assistants watch and regulate traffic. And as soon as an assistant finds freight beginning to pile up in one of the departments under his supervision, he takes steps to have it picked up. Thus, a tractor driver with a load from the pork house may pick up cheese or fancy meats or beef on his way over to the loading dock. And because the whole system has been worked out so carefully, a weekly movement of about 8,000,000 pounds of product is handled without a hitch. Located along the route is a series of assembly rooms where trailers are loaded and tractor-trains made up. To facilitate movements between floors, five large elevators, each with a cage 40 feet long, are located where needed. These elevators will accommodate a tractor and four trailers, so although the tractors can and do handle up to 20 trailers, the four-trailer train is the most effective unit when it is necessary to move loads from one floor to another.

Far from being unwieldly and hard to manage, tractor-trains are surprisingly flexible and weave their way in and out of congested assembly rooms with astonishing ease. At one point on the tramway there is a steep incline where occasionally a train of trailers would break loose and pile up at the bottom with disastrous results. Now, the floor of the incline is coated with sawdust which acts as a brake and slows up the train very effectively as it goes down the hill. And should any of the trailers become unhitched, a 4 by 4 rail down the middle of the incline prevents them from getting out of line and piling up at the bottom.

The trend toward smaller packages, so noticeable dur- used in preparing a number of our products. Take sliced bacon for example.. It is a sort of leader in every packing-house line and extreme care must be taken to see that it reaches the consumer in an attractive and sanitary container. So it is sliced and packed under special conditions.



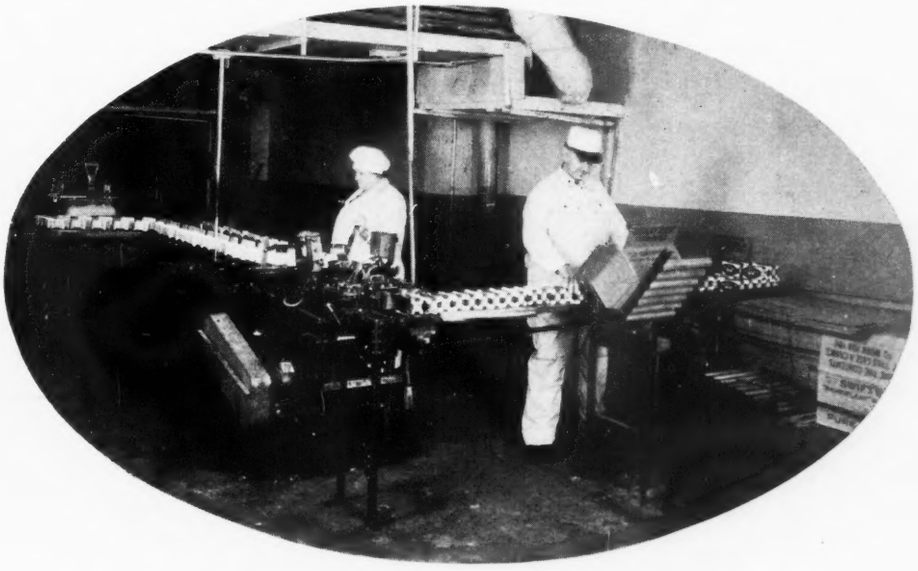
The tramway is an important element in speeding-up deliveries. It is used by trains of trailers and affords easy access from the shipping conveyor to the refrigerating cars.

Here, as in the other pork-packing departments, equipment is teamed to function with a minimum of energy and a maximum of ease and economy. And as in other departments of the plant, it has been a question of adapting to our own special uses machines and equipment ing the past few years, has revolutionized the methods that have been used successfully in other lines of industry.

The first section of the sliced bacon room contains three batteries of four slicers each. Bacon is sliced and weighed automatically into pans. Serving each battery of machines is a belt conveyor which carries the pans to the three lines of packers in the next section. Without being touched by hand, the slices are packed in one-pound cartons, in half-pound packages or in special half-pound packages with a glassine wrapping. Placed back on the same conveyors, the one-pound cartons go to the carton-wrapping machine, while the half-pound packages go to the cartoning and carton-wrapping machine. Belt conveyors again carry the cartons to the shippers who pack them in shipping containers and start them down the spiral chute which leads to the shipping conveyors two floors below.

In lard packaging, one-pound cartons come from the forming and lining machines via belt conveyors to the filling machines, the travel of the carton being so timed as to insure the proper weight of warm lard in each package. Leaving the filling machines, the two belt conveyors converge toward a duplex closing machine, and

are really divided into three distinct, five-foot sections. Each package, then, stops momentarily between sections —just long enough to prevent jamming and distortion. Emerging from the closing machine two at a time, the cartons are taken by a belt running at right angles to the packer, who is thus enabled to pick up five at a time and pack them in shipping containers. Prior to the installation of this belt, the cartons came out two at a time and moved along in the same direction. As a result, the packer could conveniently pick up only two at a time. The shipping container is placed, incidentally, on a rack which tilts forward and allows the container when fully packed to slide down a section of roller conveyor to the sealing machine.



A change of direction permits the packaging of cartons of lard in lots of five as called for by the container, rather than two at a time as delivered by the filling machine. When filled, a single forward motion starts the container on its way to the sealer.

A further illustration of the way in which we have adapted mobile equipment to fit the job and teamed it up with fixed equipment is found in the method of icing cars employed at the Robey Street plant. Cakes of ice are unloaded from freight cars on a runway along which runs an endless chain with shoes spaced at intervale of two or three feet. The shoes carry the ice down the runway to a point where it is deflected to a flight conveyor which takes it directly to the crushers in the upper story of the icing shed. The crushed ice is then chuted into tractors which have special side-dump bodies of 1,000-pound capacity, two to each tractor. It is then carried along runways in the superstructure of the building to a point over the refrigerator cars and dumped. Originally, 35 men were needed for this job. Now, 12 men and three machines handle the work and there is no overtime.

Bulk materials such as animal feed require handling equipment of a different nature. Offal is now trucked over to the animal feed house from various parts of the plant and is dumped in driers in correct proportions. When thoroughly dried, it is dumped directly on a belt conveyor and carried to the lower end of a bucket conveyor which transfers it again to a drag conveyor. From the latter it is dumped in piles and stored. A pneumatic pipe line is used to connect these piles to the grinding mills and can be fed by one man. The pipe line provides a flexible bit of equipment in that it can be set up where needed and connected to any desired pile.

These are some of the ways in which we have adapted handling equipment to our uses. And the biggest factor in its successful operation has been, not so much choosing the right tools for the right job as it is tying them all together into something that works. When it works, then and then only may it be called a handling system.

Improvements in Sugar Making Developed in Porto Rico

Possibilities of better methods in the clarification of cane juice in the manufacture of sugar have been shown recently by chemists in the Bureau of Chemistry and Soils, United States Department of Agriculture, in cooperation with the Insular Experiment Station at San Juan, Porto Rico. The results are of importance to American producers of sugar cane, to manufacturers of raw sugar, and to refiners.

Definite results obtained from the experiments in Porto Rico include improvement of the methods for controlling the clarification of sugar-cane juice by means of hydrogen-ion concentration measurements, better control of clarification by a system of continuously recording juice reactions and automatically regulating the flow of lime to the juice and, as a consequence, the better elimination of the troublesome colloidal substances from the juice of the cane by using modern chemical methods.

The experiments of the chemists from the Department of Agriculture who have gone to work with our island neighbors thus directly affect the Porto Rican planters and raw sugar manufacturers, the domestic American sugar industry, and every American family.

Economies Effected in FLOUR MILLING *by the Use of Conditioned Air*

The reduction of evaporation loss nets over $21,000 yearly

By Powell Smith
President, J. Allen Smith & Company, Knoxville, Tennessee

THE Knoxville plant of J. Allen Smith & Company, one of the South's most progressive flour mills, installed equipment in the summer of 1926 to condition air supplied to the mill buildings. The mill has a daily capacity of 1,500 barrels of soft wheat flour, 300 barrels of hard wheat flour, and 4,000 bushels of meal. Hard wheat is ground in Mill "A" with 12 stands of rolls and soft wheat in Mill "B" with 37 stands. Mill "B" is in operation nearly all the time, whereas Mill "A" is usually run at such times as hard wheat is to be ground, but may also be run on soft wheat.

The management of the mill has been studying the subject of air conditioning in flour mills for about 25 years. A miller's own practical experience early tells him that under certain atmospheric conditions his mill operates most efficiently, has a maximum capacity, gives a better yield, and has less invisible loss. At certain seasons of the year operation is more smooth than at others.

In the early studies, the management had discussed the subject with the manufacturers both of blower and of refrigerating equipment but engineering knowledge of air conditioning did not seem far enough advanced at that time to work out a solution of the problem. One refrigerating firm consulted figured out the heat given off by the mill lights in the mill, machinery and the bodies of mill operators, and for a figure of about $60,000 was willing to try out equipment at the expense of J. Allen Smith & Company. The mill owners, however, did not care to risk so large an investment on these terms.

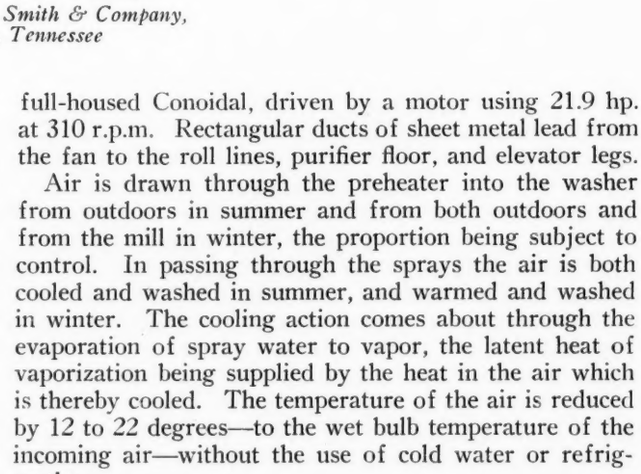
Finally, when the Carrier Engineering Corporation had developed the engineering principles which govern the conditioning of air, and had established a department headed by an expert in milling engineering, the system now satisfactorily operating in this plant was designed and installed under a definite guarantee of performance.

The air conditioning system consists of an air washer, pump for circulating spray water through the washer, preheater and reheater, fan, control equipment, and ducts for distributing the conditioned air.

The air conditioner is a No. 59-D Type H, with 270 spray heads, rated to handle about 50,000 cu.ft. per min. The motor-driven pump is a 2½-in. centrifugal delivering 162 g.p.m. at 1,750 r.p.m. against an 84-ft. head and consuming 6½ hp. Preheater and reheater contain 3,500 ft. of Aerofin radiation. The fan is a No. 11 Type N full-housed Conoidal, driven by a motor using 21.9 hp. at 310 r.p.m. Rectangular ducts of sheet metal lead from the fan to the roll lines, purifier floor, and elevator legs.

Air is drawn through the preheater into the washer from outdoors in summer and from both outdoors and from the mill in winter, the proportion being subject to control. In passing through the sprays the air is both cooled and washed in summer, and warmed and washed in winter. The cooling action comes about through the evaporation of spray water to vapor, the latent heat of vaporization being supplied by the heat in the air which is thereby cooled. The temperature of the air is reduced by 12 to 22 degrees—to the wet bulb temperature of the incoming air—without the use of cold water or refrigeration.

Air leaving the spray chamber passes through a series of metal baffle plates which serve to remove all remaining dust particles and unevaporated water from the air stream. The air, now saturated with moisture, passes into the reheater where it is brought to the proper temperature and relative humidity for delivery to the milling departments.



Two typical rows of roll stands showing the distribution ducts and outlets through which conditioned air is delivered to each roll

The dew point control system maintains both temperature and relative humidity at any predetermined values. Thermostats located just after the baffles or eliminators in the spray chamber and others in the mill operate through compressed air to admit steam to preheater, reheater, and spray water line as needed to effect the required regulation. In winter about 80 per cent of the air drawn into the washer is recirculated from the mill and reduces steam consumption otherwise needed to heat 100 per cent of outdoor air. All conditioning equipment, including washer, eliminators, fan pump, motors and controls, occupies a room 24 x 40 x 10 ft. high. The actual floor space covered by the apparatus is about 25 ft. x 14 ft.

Conditioning Requirements

The system of air conditioning was installed to accomplish five ends:

1. To enable the mill to control the manufacturing process so that a uniformly high grade of flour could be milled.
2. To maintain capacity at as high a figure as compatible with the desired quality.
3. To keep the flour yield as high as possible compatible with quality.
4. To reduce the evaporative invisible loss and yet keep the moisture content of the flour at an optimum figure, well within the limits established by the Federal Food and Drugs Act.
5. To eliminate coal soot, dust, and other foreign material of all kinds from the finished product.

Under ordinary operating conditions, without any means of air conditioning, a mill ordinarily operates at best efficiency during the spring or fall months when temperature and relative humidity are most favorable and their variations are a minimum during the 24 hours. It would follow, therefore, that if such weather conditions as prevail under the best natural conditions can be maintained for 24 hours a day throughout the year, the mill will be able theoretically to operate continuously at best efficiency, and the miller will be able to control closely the milling of his stocks. Air conditioning enables the mill to maintain the most efficient weather condition within fairly close limits.

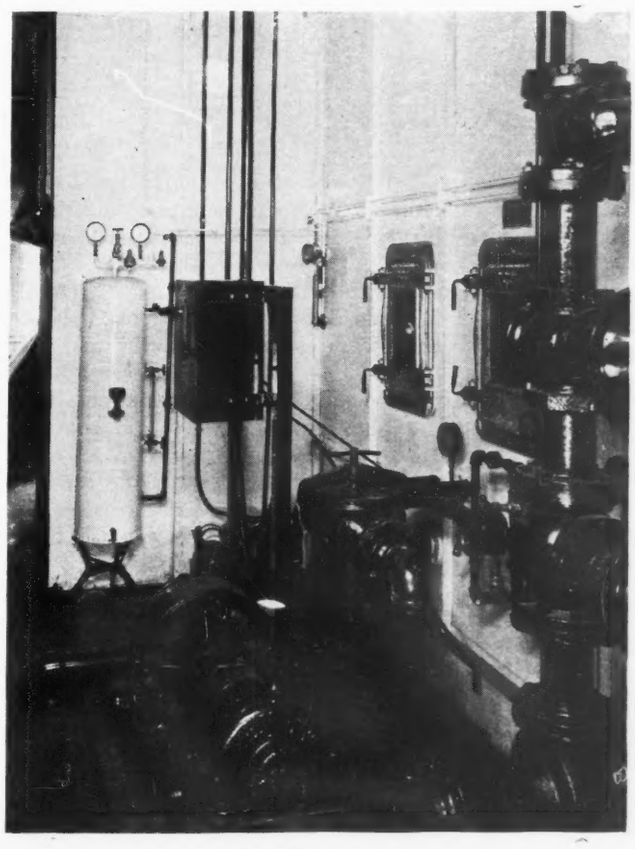
TABLE A—DRY-BULB TEMPERATURES AND RELATIVE HUMIDITIES DURING TYPICAL SPRING AND SUMMER WEEKS OF 1927

March		Outdoor		Mill		July		Outdoor		Mill	
Day	Hour	T	Per Cent R.H.	T	Per Cent R.H.	Day	Hour	T	Per Cent R.H.	T	Per Cent R.H.
21	8 A.M.	64.8	77	76	64	25	8 A.M.	68.3	71	78	56
	Noon	67.4	78	76	65		Noon	82.2	48	81	57
	8 P.M.	49.5	75	76	64		8 P.M.	81.2	56	82	57
22	8 A.M.	35.8	66	74	49	26	8 A.M.	71.6	79	82	57
	Noon	40.8	59	75	50		Noon	84.6	42	84	48
	8 P.M.	38.0	67	74	50		8 P.M.	82.0	52	82	57
23	8 A.M.	36.8	67	73	52	27	8 A.M.	71.0	76	82	54
	Noon	48.0	52	74	50		Noon	87.4	42	83	55
	8 P.M.	52.7	44	74	50		8 P.M.	83.1	55	84	59
24	8 A.M.	43.0	90	74	50	28	8 A.M.	74.0	76	84	55
	Noon	42.4	86	74	50		Noon	88.0	49	86	53
	8 P.M.	43.3	90	74	50		8 P.M.	86.0	51	86	56
25	8 A.M.	36.0	100	74	50	29	8 A.M.	75.0	53	84	55
	Noon	50.9	58	75	54		Noon	90.1	49	88	54
	8 P.M.	57.0	41	76	51		8 P.M.	82.5	67	88	57
26	8 A.M.	53.7	59			30	8 A.M.	75.7	76	86	56
	Noon	59.0	68	Mill			Noon	85.8	55	88	54
	8 P.M.	57.0	32	Down			8 P.M.	79.1	75	86	56

Table A gives outdoor and indoor temperatures and relative humidity percentages for a typical spring week when production is high under natural conditions, and for a typical summer week when efficient operation is impossible without air conditioning. In both cases, despite variations outside, the atmosphere inside the mill is held close to the ideal conditions with little variation. During the spring week inside relative humidity was held close to 50 per cent and during the summer week to 55 per cent.

In summer the inside temperature was from 78 to 88 deg. F.—considerably lower than would have been true had not the cooling effect of the sprays offset the heat generated by the processing machines. The drop in temperature is dependent upon the outside wet-bulb temperature which varies widely and cooling below the temperatures shown would require cold water for the sprays. The management may sink a well before the next summer season to permit cooling the air still further.

In summer the heat from rolls and bearings on the roll floor raises the temperature of the stocks to such a point that evaporation of their moisture occurs. Hot mill stocks become sticky and neither break nor grind well. Thus there results a decrease in both capacity and amount of flour obtained from a given quantity of wheat. Moisture lost from the berry is an invisible but serious and irrecoverable loss—weight for which the miller has paid. With the air conditioning system installed cool moist air is blown directly between the roll stands and heat generated in the rolls and bearings is absorbed. The stocks are thus kept in the best condition for milling.



A glimpse of the humidifier-air washer showing the water circulation pump, piping and automatic control valves

On the purifier floor air comes in contact with the stocks as they pass through the machines, and unless this air is cool and moist it exerts considerable drying effect on the middlings, resulting in loss of weight. Furthermore, when the air is warm and the stocks sticky, the meshes of the bolting cloth become clogged, cutting down capacity. The new equipment bathes the purifiers in

properly conditioned air, controlling temperature, and avoiding loss in weight. No air is directly conducted to the sifter floor, cleaning department, or spouting floor but passes to them from the roll and purifier floors.

Effect on Production

The points already discussed are subject to study in the light of actual mill performance. Tables B and C give data by months on outside weather and mill performance over two years from July 1, 1924 to June 30, 1926, prior to the installation of the air conditioning system, and for the following year from July 1, 1926 to June 30, 1927.

TABLE B—MONTHLY MEANS OF TEMPERATURE AND RELATIVE HUMIDITY FROM U. S. WEATHER BUREAU RECORDS

	Dry-Bulb Temperatures, Per Cent			Relative Humidities, Per Cent		
	1924–25	1925–26	1926–27	1924–25	1925–26	1926–27
July	75.1	79.4	78.2	70.0	58.2	62.9
August	77.9	77.9	78.0	66.3	52.9	73.8
September	65.9	79.6	76.8	72.3	61.6	73.1
October	60.1	56.7	60.8	67.3	74.0	74.9
November	50.5	46.6	44.2	68.3	69.4	73.5
December	40.0	39.0	41.6	70.0	66.4	78.1
January	41.2	38.4	40.0	73.3	70.7	73.9
February	47.0	44.2	50.4	70.7	61.4	74.2
March	51.7	43.0	51.3	60.3	55.3	71.8
April	63.4	55.6	62.0	59.7	52.3	69.0
May	64.0	67.6	68.8	59.3	55.2	66.8
June	77.9	78.2	77.9	59.3	64.0	73.1

Table B shows clearly the wide outdoor variations and the substantial similarity of the conditions for these three periods, especially for 1924-25 as compared with 1926-27.

Table C gives comparative figures for capacity (total monthly production divided by the equivalent 24-hour periods of mill operation), cleaned wheat yield, and net evaporation gains.

Capacity was formerly subject to wide variation. The average daily capacity shows an increase of 1.8 per cent in 1926-27 over 1925-26, but 1924-25 shows 2.3 per cent over 1925-26. In other words the year after the air conditioning equipment was installed shows an increased capacity over the previous year, but that year in turn shows a decrease as compared with the year before.

Yield is substantially the same for all three periods.

Evaporation loss, however, has been markedly affected. During the year prior to the installation there was a substantial loss in every month except April. For the preceding year this loss was even greater. But for the year after installation there was a loss during only four months and a gain during eight months, with an actual net gain shown for the year of considerably more than 1 per cent in favor of the conditioned period.

Evaluation of Improved Conditions

The records show that in the summer months there is an increase in capacity up to 190 bbl. per day, whereas in the winter months there is a loss in capacity up to 130 bbl. per day. This refers to 1925-26 as compared with 1926-27. At first thought it might seem best to shut off the conditioning system during the winter months rather than lose capacity. But high capacity in winter is due to cold, brittle stocks, since the temperature of these stocks is affected by the wet-bulb temperature of the air within the mill.

In reaching this low wet-bulb temperature the stocks must lose moisture, and the quality of their products is thereby adversely affected. A study of the records in this mill shows that the loss in capacity is more than offset by the decrease in evaporation, leaving quality entirely out of consideration. The value of a barrel of increased capacity is estimated at approximately $1 in conversion cost. The value of a pound of product—74 per cent flour at four cents per lb. and 26 per cent feed at one and one-half cents—is approximately three and one-third cents per lb. The decreased capacity, therefore, for five winter months is worth about $5,700 and

A typical row of purifiers which are continuously bathed in conditioned air to prevent evaporative loss from the stocks

the decreased evaporation loss is valued at about $6,600, a net gain of $900 over the gain accruing from uniform and enhanced flour quality.

The added profits due to the elimination of evaporative loss are evaluated in Table D. The total gross saving at an assumed 400,000 bbl. output is $26,800. From this figure must be deducted the slight decrease in capacity as compared with 1924-25, thus leaving a saving of $24,800. From this figure must be deducted the fixed charges and operating costs of the installation, shown in Table D to be $3,481.45, leaving a net saving of $21,318.55. This is a net return on the investment of 125 per cent. In other words, the installation of the air conditioning system was paid for before it had been in use a full year.

Intangible Advantages

In addition to the tangible savings already discussed the equipment has shown other very valuable advantages. Knoxville is located among the heavily wooded foothills of the Smoky Mountains on the banks of the Tennessee River. Often on damp mornings a heavy pall of fog in which is entrapped coal smoke and soot from the soft coal furnaces in homes and factories, and from the locomotives in the nearby railroad yard, settles down over the valley. On the hills it may be a bright

day, whereas near the mill automobile headlights are needed. This smoke and soot-laden air used to be drawn into the mill through windows and doors by the suction on the various machines. Many mornings the mill would be shut down for from two to three hours until the smoke-laden fog had cleared away. If the mill were run

Another row of roll stands. Here is shown the careful design, well fitted and rigid construction of the air duct

under these conditions the flour would lose its bright color which the management will not permit.

Under present conditions no air can enter the milling system or the mill itself except through the air washer where all dirt, soot, and smoke is removed. The air discharged into the mill through the ducts keeps the interior at a slight pressure above the outdoor atmosphere so that movement of air is to the outside rather than from the outside in. Even with windows open in summer this is still true. Since the installation of the air conditioning system not an hour has been lost because of smoke. In cold weather three to four hours were often required on Monday mornings to warm up the rolls and other machinery before the mill might operate properly. Now the new system is started at 5:00 to 5:30 a.m. and the mill is in regular production by 6:00 o'clock.

While this system was installed primarily to enable the management to maintain the high quality of its product under all weather conditions it has, as outlined above, paid big dividends through the elimination of evaporation loss. At the same time it has greatly improved working conditions. Formerly, in hot summer weather, the roll floor frequently reached a temperature of 112 deg. F., whereas now the highest point reached is 88 deg., a comfortable temperature as compared with 112 degrees and especially so since the air is in constant motion. Men from the office frequently go into the mill to get cool. Another advantage is the cleanliness of the mill. Inasmuch as the interior of the mill is under a positive air pressure, dust from the machines and elevator legs has less tendency to filter out into the mill.

TABLE C—EFFECTS OF AIR CONDITIONING ON CAPACITY, EXTRACTION YIELD AND WEIGHT OF TOTAL PRODUCT

Capacity

Comparative Production Data	Per Cent 1924–25	1925–26	1926–27
July	84.3	96.5	100.0
August	86.9	83.0	96.5
September	95.7	78.0	91.5
October	100.0	99.3	99.0
November	109.0	101.5	101.0
December	109.0	106.4	104.0
January	115.0	106.7	106.0
February	116.9	106.8	106.0
March	113.9	118.6	109.2
April	105.7	114.5	108.6
May	102.6	101.9	103.7
June	89.3	87.8	96.5
Average	102.3	100.0	101.8

Comparisons

1926–27 as compared with 1924–25 (Weather practically identical) ..... 0.5% loss

1926–27 as compared with 1925–26 (Difference in weather considered to account for above gain) ..... 1.8% gain

Extraction Yield

Records for three yearly periods corresponding to above show 1.5 lb. less wheat required per barrel of flour in 1926–27 with air conditioning than in 1925–26. However, there was no substantial difference in extraction yield in 1926–27 as compared with 1924–25.

Weight of Total Product

The average weight of finished product as compared with the weight of wheat ground, in the period during which air was conditioned, exceeded that for the 1925–26 period by 1% or 2 lb. per bbl., and exceeded that for 1924–25 period by a slightly greater amount.

TABLE D—SAVINGS EFFECTED BY AIR CONDITIONING

Saving Due to Improvement in Weight of Total Product

Increase during year of air conditioning as compared with two years without air conditioning—over 2 lb. per bbl.

Value per lb.—0.74 lb. @ $0.04	$0.0296	
0.26 lb. @ $0.015	0.0039	
1.00 lb.	$0.0335	
Saving on basis of 400,000 bbl. run 400,000 bbl. x 2 lb./bbl. @ $0.0335		$26,800.00

Loss Due to Capacity Decrease

Decrease during year of air conditioning as compared with year during which temperature and relative humidity conditions were most nearly the same—0.5%.

Conversion cost assumed as $1.00 a bbl. Loss on basis of 400,000 bbl. run 400,000 x 0.005 @ $1.00 ..... 2,000.00

Gross saving $24,800.00

Operating Cost

Depreciation, $17,000 ÷ 15-yr. life	$1,133.33	
Average interest @ 6%— 16/15 x $17,000 x 0.06/2.	544.00	
Maintenance and repair allowance	300.00	
Power—29½-hp. @ $42.00 per hp. per year	1,228.50	
Steam—511 M. lb. @ $0.45	229.95	
Water—38.06 M. cu.ft. @ $1.20	45.67	
Total annual fixed and operating costs		$3,481.45

Net Annual Saving Effected

At assumed 400,000 bbl. output	$21,318.55
Net annual return on investment	125%

To Study Forgotten Foods

Old reports of explorers and the earliest pioneers, such as the report of the Lewis and Clark Expedition give the names of many foods used by Indians of that day that are practically unknown at present.

In order that our knowledge of our national food resources may be more nearly complete Mr. C. R. Greenleaf of the Bureau of Chemistry and Soils, in addition to other duties, has been assigned to make a study of the food value of these indigenous plants. It is probable that their vitamin content will receive attention for it has been recorded that many of the Indians suffered from sore eyes. It is possible that this disease may be what we know today as xerophthalmia.

The investigation will be made under the direction of Dr. F. C. Blanck, in charge of the Federal Food Research Division, and will be made in co-operation with the Bureau of Plant Industry.

SURPLUS FRUITS

What Shall We Do With Them?

By W. V. CRUESS

Fruit Products Laboratory, University of California

ALTHOUGH it has not received the nation-wide publicity accorded the cotton or the corn surplus, the fruit surplus has become of paramount importance to those directly concerned; that is, the fruit growers and those engaged in the preparation, preservation, and distribution of fruit products. The prosperity of both fruit growers and fruit products manufacturers depends upon what is done with the rapidly increasing surplus of certain fruits. Not only does overproduction affect those fruit industries in which the surplus occurs; but it also affects others in which production has not unduly increased. If canned peaches are cheap and in excess of normal demand, canned pears and canned apricots suffer a drop in price or in demand or both.

Several causes have probably contributed to the rapid increase in production of some fruits. One of these has been the need of finding profitable crops for some of the rich agricultural lands of Western States brought under irrigation in recent years. Another has been the planting of large tracts to fruit for subdivision; a common form of real estate promotion not always profitable to the small investor. However, the most important cause has probably been the high prices for fruit that prevailed during the last years of the World War and for a year or two following the close of the War. This was particularly true of those fruits that are used for canning, drying, and preserving. As the fruits used for these purposes are produced most extensively on the Pacific Coast, it is in this region that the pressure from the surplus has been most acute.

INCREASE IN FRUIT ACREAGE

The fruit situation in California may be taken as being typical of the other Pacific Coast States. According to data collected by the California Crop Reporting Service the acreage of every important field crop declined markedly during the past five years, the percentage decrease ranging from 13 per cent for hay to a decrease of 40 per cent for wheat, grain, sorghums, corn, and beans. During that period the percentage increases in acreage of most fruits was even greater than the decrease in acreage of field crops. Fruits gave greater returns than field crops at the beginning of the period; hence the change. The magnitude of the increase of certain California fruits is indicated by the following table:

TABLE I—PERCENTAGE CHANGE IN TOTAL ACREAGE OF CALIFORNIA FRUITS BETWEEN 1920 AND 1925
After *The Agricultural Situation in California,* Univ. Calif. Agr. Exten. Circ. *18,* 1928.

Fruit	*Per Cent Increase or Decrease*	*Fruit*	*Per Cent Increase or Decrease*
Figs.....	+156	Cherries.....	+19
Grapefruit	+103	Prunes.....	+14
Almonds...	+82	Oranges.....	+7
Apricots...	+55	Lemons.....	—5
Pears.....	+48	Table grapes.	+130
Peaches...	+46	Raisin grapes	+66
Plums.....	+46	Juice raisins..	+46
Walnuts...	+33	All grapes....	+71
Olives.....	+22		
Average all fruits.....	+43		

Increase in plantings of some fruits had proceeded rapidly before 1920. Thus the bearing acreage of figs in 1915 was 5,709; by 1920 it had doubled and by 1927 it had become more than four times that of 1920, and more than eight times that of 1915. The bearing acreage of pears increased nearly 100 per cent between 1915 and 1920; by 1927 it was nearly four times the bearing acreage of 1915 and twice that of 1920. In other words, the high prices of the immediate post-war period were not entirely to blame for all the expansion.

INCREASE IN FRUIT PRODUCTS

The reader is probably more interested in fruit products than in the acreages of fruits or the production of fresh fruits. The two most important deciduous fruit products are canned fruits and dried fruits. The following table indicates the rapidity of increase in production of some of the more important varieties of canned and dried fruits in California. Similar increases have occurred in the Pacific Northwest in Oregon and Washington.

TABLE II—PRODUCTION OF SEVERAL IMPORTANT CANNED AND DRIED FRUITS IN CALIFORNIA

Year	*Canned Peaches, Cases*	*Canned Pears, Cases*	*Canned Apricots, Cases*	*Raisins, Tons*	*Prunes, Tons*
1895	708,600	263,483	407,000	45,500	21,375
1900	1,041,089	641,722	618,079	47,000	87,000
1905	1,903,180	498,812	713,895	45,000	31,250
1910	2,504,700	670,585	941,790	62,500	40,000
1915	3,239,523	827,630	981,190	128,000	92,500
1920	6,753,198	1,184,288	1,150,514	177,000	97,250
1925	10,456,901	2,315,600	2,196,680	200,000	146,000
1926	14,472,077	2,044,414	3,390,418	285,000	150,000

Year	*Dried Figs, Tons*	*Dried Peaches, Tons*	*Dried Apricots, Tons*	*Walnuts, Tons*	*Almonds, Tons*
1895	1,375	12,250	5,325	3,385	No data
1900	3,000	17,170	14,040	5,430	2,740
1905	3,200	18,000	1,800	6,400	2,100
1910	3,775	25,000	15,250	9,600	3,300
1915	8,600	32,250	19,500	14,825	3,500
1920	12,300	27,000	9,500	21,000	5,500
1925	9,600	16,170	18,000	36,000	7,500
1926	11,350	28,200	18,800	15,000	15,750

The undue increase in production of certain fruits has naturally reduced their relative value or purchasing power as the following table shows:

TABLE III—PERCENTAGE CHANGE IN PRICES OF CALIFORNIA FRUITS BETWEEN 1921-22 AND 1926-27
After *Univ. of Calif. Agr. Exten. Circ. 18, 1928.*

	Per Cent Change		*Per Cent Change*
Figs	—44	Walnuts	+10
Prunes	—37	Cherries	+18
Plums	—33	Oranges	+27
Peaches	—30	Table grapes	—64
Olives	—26	Juice grapes	—39
Pears	—20	Raisin grapes	—33
Apricots	0		

There are several exceptions to the rule that the purchasing power of fruits has decreased. Apricots have until a short time ago, held their own because the relatively recently planted acreage has not reached full bearing. The supply of California grown walnuts and almonds is still much below the amount consumed; because of present protective tariffs and the vigorous sales policy of the nut growers, two co-operatives, almonds and walnuts, are still yielding good returns.

Oranges tell still another story. The recent increase in acreage in California has been modest compared with that of most other fruits; consequently increase in production has more nearly kept pace with increase in demand. But this is not the whole story. The California Fruit Growers Exchange, that is the citrus fruit growers co-operative, a number of years ago saw the "hand writing of old man surplus on the wall" and undertook a well-financed and well-sustained advertising campaign of the healthful qualities of orange juice. This advertising has been supported by an equally vigorous campaign carried to the dispensers of fountain drinks and to restaurants, hotels, and cafeterias. Most soda fountains have the Exchange's now familiar orange juice extractor on display and in use on their counters. Most well-equipped homes have one or more small orange juice extractors; and what is more these are used. One estimate has placed the value of the fresh orange juice business at more than $20,000,000 annually. We are drinking the surplus oranges; in fact I doubt whether one could find much of an orange surplus in California at present.

RELATION OF THE FRUIT SURPLUS TO OTHER FOOD INDUSTRIES

As might be expected, many plans have been advanced to solve the fruit surplus problem. Among these may be one or more plans that will lead the fruit growers out of the wilderness. Among others are the following:

One suggestion frequently made and in fact used more or less widely is: *advertise the surplus into consumption.* But Dr. C. L. Alsberg and Dr. A. E. Taylor of the Food Research Institute at Stanford University and others have indicated the fallacy in this argument. We consumers can eat only just about so much food—in fact the average American now consumes more food daily (expressed in calories) than does the average consumer in most other countries. In addition, Dr. H. E. Erdman, Chief of the Agricultural Economics Division at the University of California, has found that the per capita consumption of fruit has not changed appreciably during the past twenty years. It has averaged about 190 pounds per capita a year. While production of some fruits in the West has increased, apparently fruit production has decreased in other sections; undoubtedly by the passing of the family orchard of former years. Taylor and Alsberg state that if we are "advertised" into eating more of one fruit we shall have to "cut down" on some other fruit or food. Already fruit has displaced bacon, and other "hearty" foods, on the breakfast table.

A second suggestion is: *export the surplus.* Well and good, provided our overseas customers speed up the heretofore very slow recovery of their former purchasing power. Russia has many millions who get little fruit and who would doubtless like California dried prunes and raisins; the same is true of China and India. But how to reach these markets is the problem. We are not on the best of terms with Russia and the Chinaman's and Hindu's purchasing power is very, very low. Italy, Spain, and France are exporters of fruits. The British Isles are already good customers for our fruit and fruit products and may be induced to take more of them. However, this market is conservative and expansion is slow. The Latin American countries perhaps offer export possibilities.

MANY PLANS UNDER CONSIDERATION

A third suggestion is: *put a prohibitive tariff on fresh fruits, particularly on bananas.* If the Pacific Coast fruit grower could put the banana importer out of business, all would be well with his fruit surplus—at least so he thinks. But to double the price of bananas by a tariff would raise a greater commotion than taking beer and wine away from the American working man.

Another suggestion is: *let the Government buy up the surplus à la McNary-Haugen and then let the Government do the worrying.* Fine for the fruit grower, but a bit rough on the U. S. Treasury. One recalls that the Sicilian government tried this very thing after the war and bought up the surplus citrate of lime at a good price. The growers and citrate manufacturers feel that they were in clover and proceeded to pyramid the "surplus" at a tremendous rate. The scheme "busted" the Govenment's rather limited treasury and the industry is again trying to make its own living instead of living off the government. We are not saying we are for or against the McNary-Haugen plan, taking it now in the broad general sense of the government caring for the surplus; but so far as perishable fruits are concerned we doubt its ability to solve the surplus problem.

Another plan suggested to the individual grower is: *diversify.* Fine! but if the fruit growers all diversify by adding some chickens, a pig or two and some garden truck, they still have the fruit surplus and all they have done is to provide more competition for the none too prosperous egg producer and others.

CANNING, PRESERVING AND DRYING THE SURPLUS

The figures given in Table II show that the canners and dryers have shouldered their share of the growers' increased and increasing production. Canneries have doubled and trebled their capacity and worked overtime to pack ever increasing amounts of canned fruits and have thereby caused their sales managers many sleepless nights. Dried fruit co-operatives have actually over-extended their facilities to meet the situation and have gone through several hectic years with the end not yet in sight. There have been failures of co-operatives and near failures in spite of heroic efforts to hold the growers together in the face of fierce competition from the independent packers who have used the surplus to batter down prices.

Canning, drying, and preserving convert perishable

fruits into more or less non-perishable products and in this way prolong the marketing season. These industries have taken much of the surplus and have facilitated marketing by raising the standard of fruit accepted for conversion into products. This has forced much of the surplus into the class of "culls." After all this is one very practicable method of "disposing" of the surplus; make quality standards so high that the lower grades of fruits are rejected and discarded. The resulting improved general quality of the pack makes it more readily sold and tends to increase demand. The canning, preserving, and dried fruit industries are already "on the job," a great advatage over the other agencies that might some time in the future be created to care for the surplus. Growers should co-operate rather than quarrel with these agencies and the canners, preservers and dried fruit packers should also consider the growers' welfare.

Byproducts

If the canner, preserver, and dried fruit packer reject a large per cent of the fruit crops as unfit for their use we then have a rapid increase of cull fruits. That shifts the surplus problem from the grower, first to the canner and then to the byproducts industries. What are the possibilities here?

Well-known fruit byproducts are: vinegar, industrial alcohol, and stock foods. Reasonably good vinegar can be made from dried fruits and from cull grapes, apples, pears, and oranges. But the demand for vinegar is rather fixed; it is difficult to induce consumers to use more of it at any price. Perhaps a high quality grape vinegar would find a market.

Industrial alcohol manufacture could use all of our fruit surplus and call for more, provided the fruit could be delivered to the plant at a price sufficient to pay for transportation and handling; with any profit to the grower omitted. For example, suppose we take peaches with 10 per cent of fermentable sugar and assume that it might be possible to get 5 per cent by weight of alcohol or about 13 gallons per ton of fruit. Suppose the price of alcohol were 40c. a gallon to the manufacturer, the wholesale value of alcohol from a ton of fruit would then be $5.20; in actual practice it would probably be nearer $4.20. You can readily see where this leads us. Cull dried fruits could possibly be so utilized with some return to the grower, as they contain about 60-65 per cent sugar and are easily transported.

If supplemented with concentrates and field crop stock foods, some cull fruits, particularly dried fruits, can be used successfully as stock foods. The Animal Husbandry Division of the University of California has done excellent pioneering work in this field. Possibly this use could be extended. While the returns are very low to the grower, because these foods must compete with corn, barley, and hay, yet the fruit is taken from competitive channels into one that does not compete with fruits. In this way it would enhance indirectly the value of the fruit of better quality.

New Uses

A number of years ago raisin prices dropped to a ruinous level because of overproduction. The surplus grew and finally reached alarming proportions. A new use was found for raisins, namely, in raisin bread. Raisin bread was demonstrated and nationally advertised by the Raisin Association. It became a well-known and staple food product of increasing popularity. Incidentally, it solved the surplus raisin problem of that day. If California had not accumulated in the interim such a surplus of optimists who planted "everything in sight" to raisin grapes, probably the raisin industry would still be profitable. They overdid a good thing with the usual results; the raisin surplus is now a real one. At any rate, the raisin growers demonstrated what could be done when an important new use for fruit is developed.

It is this method of attack that appeals to me as having greatest promise of solving the fruit surplus problem. A few examples will illustrate the possibilities.

According to J. H. Irish (Circular *313,* Univ. of Calif., Agric. Exp. Sta.) about 8,000,000,000 bottles of carbonated beverages other than cereal beverages and mineral water are consumed annually in the United States. This would be approximately 1,000,000,000 gallons of liquid. At present very little of this great total is made from fruit; although much of it is sold under "fruity" names such as "grape," "orange," "strawberry," etc. Suppose 25 per cent of it, or 250,000,000 gallons, were made from fruits. This would represent at least 1,250,000 tons of fresh fruit, an amount much above the entire surplus of fruits suitable for the purpose. Using fruit in these drinks would not compete with other uses for fruits. Probably there is an equal or greater opportunity for the use of fresh fruits for making fruit syrups for fountain use and for home made beverages. The great popularity of orange juice for these purposes indicates what might be done with other fruits.

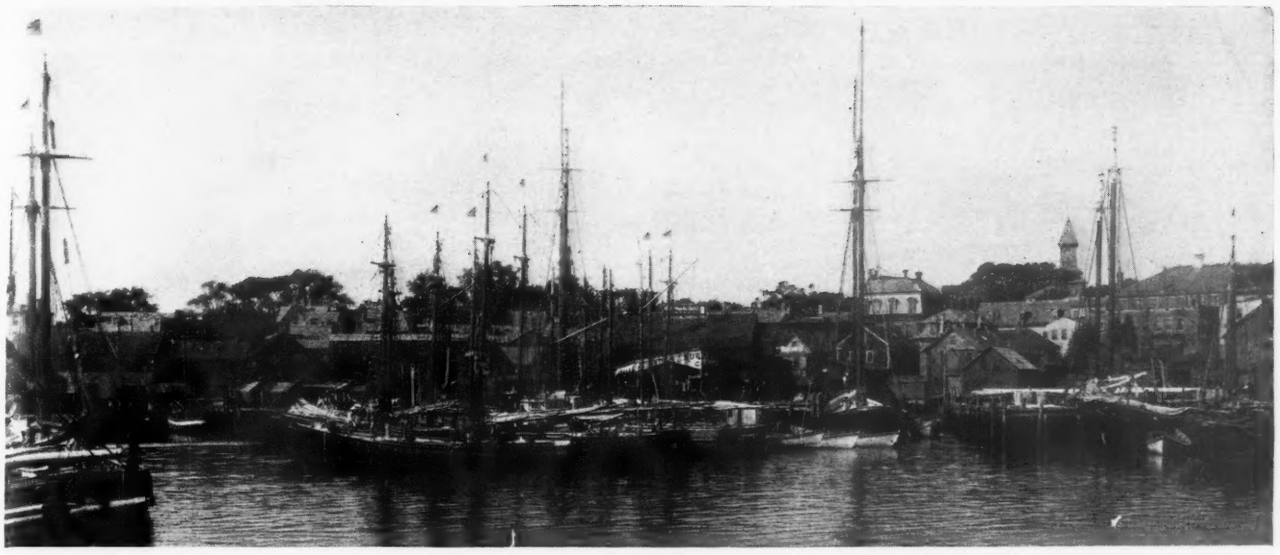
The candy industry is a very large and important one. Very little fruit is at present used in candy although there are many imitation fruit candies. Fruit properly used in various standard candies such as fudge, marshmallow, gum drops, nougat, caramels, cream centers, etc., not only improves the flavor of the candies but also increases their healthfulness. Fruit renders candy "less filling," i.e., more can be eaten without discomfort because the fruit counteracts the "dead sweetness" of "all-sugar" candies. Candy makers could use the now well-known and widely advertised "health appeal" of fruits to increase the sales of candy. It is a case where the fruit and the candy industries could co-operate to mutual advantage and from the combined viewpoint of manufacture and sales.

What is true of candy is true also of ice cream. Much more fruit could be used in this popular dessert. Too often "fruit ice cream" and "fruit ice" are fruit only in name. Fruit is cheap and plentiful; one wonders why more of it is not used by the ice cream industry.

Bakery products make use of little fruit beyond that used in pies and in raisin bread. Undoubtedly there are possibilities for greatly expanding the use of fruit in bakery products with as great or greater benefit to the baker as to the fruit grower. Another case for co-operative effort.

Finally it may be said that much depends on the manufacturers and dealers in equipment for the food industries. New processes and new equipment must be developed for most of these new fruit products and for using them in other basic food products. There is an opportunity for the great bottlers' supply companies to foster a real fruit beverage industry that will use their equipment; for the bakers' supply companies to aid in establishing new bakery products made with fruits; for the candy makers' supply industry to aid in perfecting and developing the use of fruit in candy.

If the fruit growers, the food industries, and the food equipment industries co-operate on the surplus fruit problem it can be solved with benefit to all concerned, including the consumer.



Picturesque Gloucester, typical of the romance of the ancient and honorable fishing industry, is the home of the latest technical developments in modern fish preparation and packing

Quick Freezing of Filleted Fish

By LEICESTER H. SHERRILL

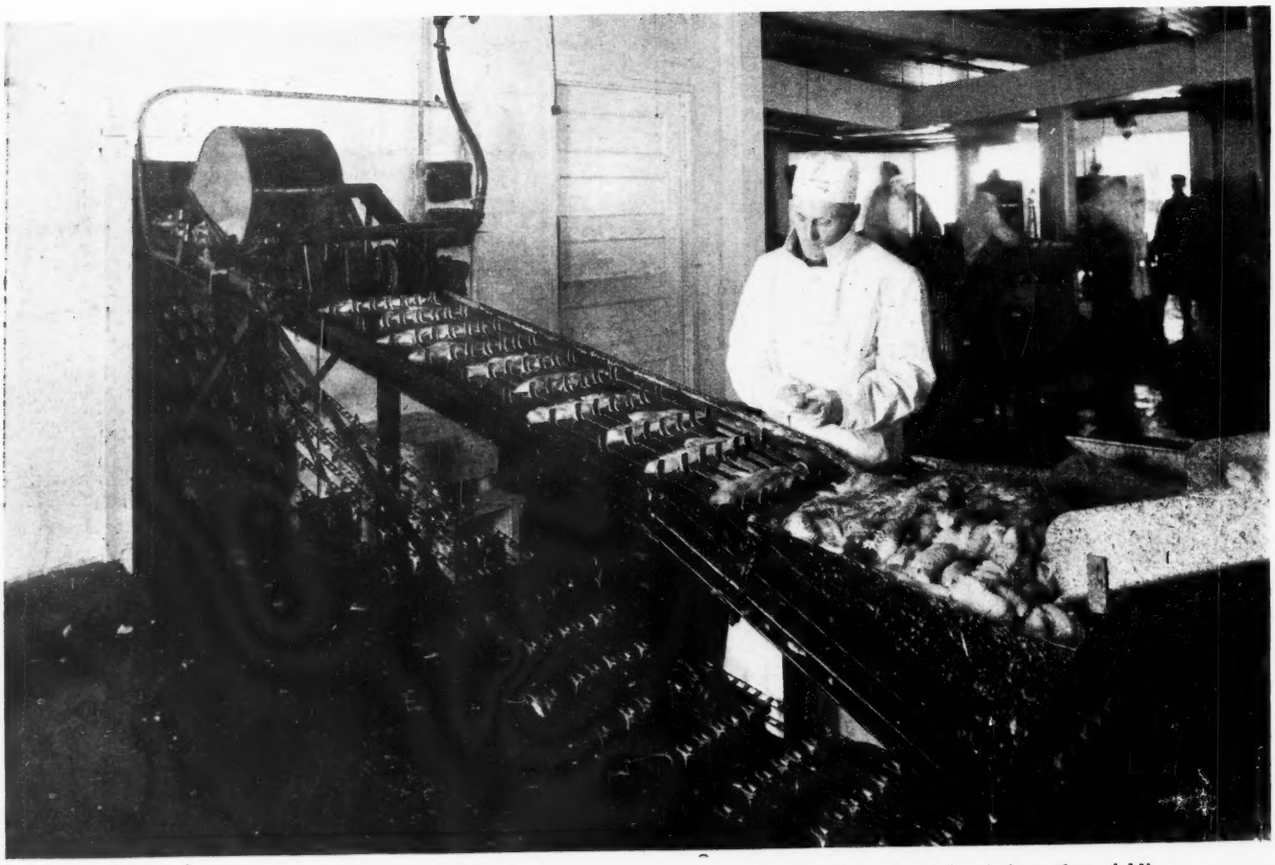
General Seafoods Corporation, Gloucester, Massachusetts

FOR many years wholesale and retail fish firms have prepared fresh fishery products, such as fillets, steaks, sticks, and pan-dressed fish. Fillets, the finless and practically boneless sides of the fish with or without its skin, are cut mainly from haddock, lesser quantities coming from cod, cusk, hake, mackerel, sea trout, grouper, blue pike, sheepshead, and perch. Larger fish such as cod, salmon, and halibut furnish fish steaks, which are cross-wise one-inch cuts of the meat portion, free of all waste material except the bones. A fish stick is a more or less local term and refers to a fillet cut cross-wise into three or more portions. Pan dressed fish have the viscera, scales, fins, and head removed and include scrod haddock, sea bass, baby mackerel, butterfish, sea trout, and croakers. Practically all species of edible fish are appropriate for this sort of handling.

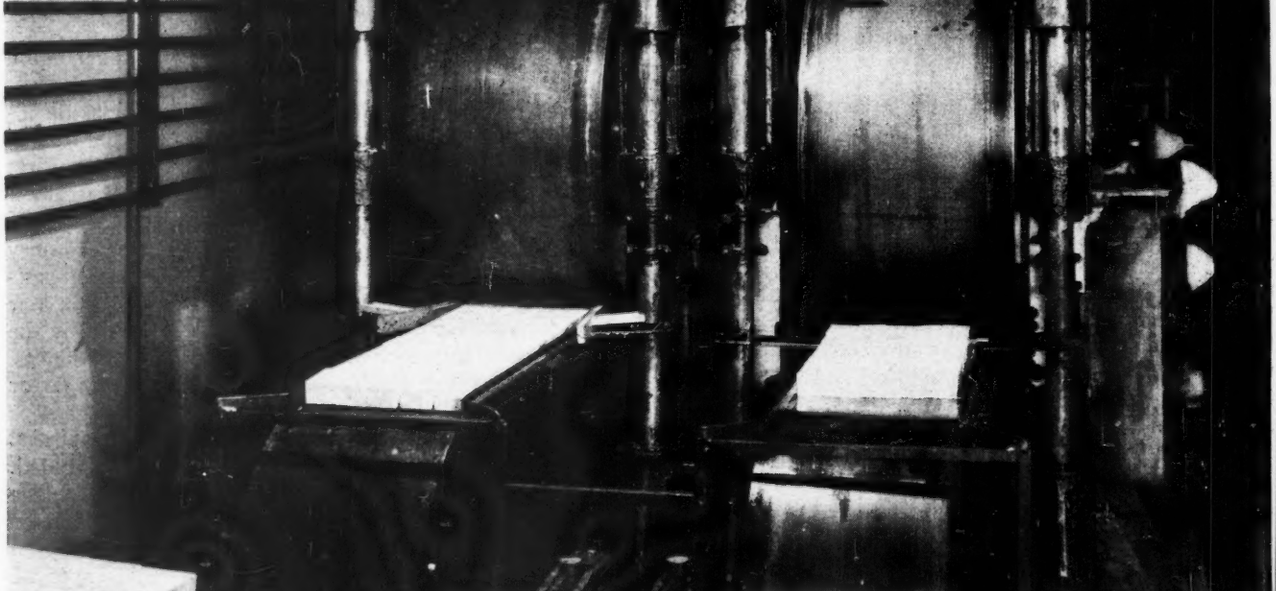
Products of this sort are sold in cartons and other types of package and are marketed fresh or frozen. Among those who freeze their products it is a generally accepted fact that if frozen seafoods are to retain their original qualities they must be frozen quickly. This has come to mean the use of one or the other of the so-called brine freezing methods. Brine freezing is employed in two fundamentally different ways: that in which the product is directly immersed in, or sprayed with, sodium chloride brine, and that in which it is enclosed in a can or mold and this mold immersed in, or sprayed with, calcium chloride brine or some other liquid having a very low freezing point.

Direct immersion or spraying has three serious disadvantages, namely, the product is likely to be distorted in freezing, it will not take a glaze until the brine has first been washed off and the product re-cooled, and it cannot be packed before being frozen lest the container itself become saturated with the brine. Also, because ordinary brine freezes at about —6 deg. F. it is obviously impossible to use very low temperatures with this method; nor is it fully satisfactory to lower the freezing point by the addition of glycerin or other freezing-point depressants.

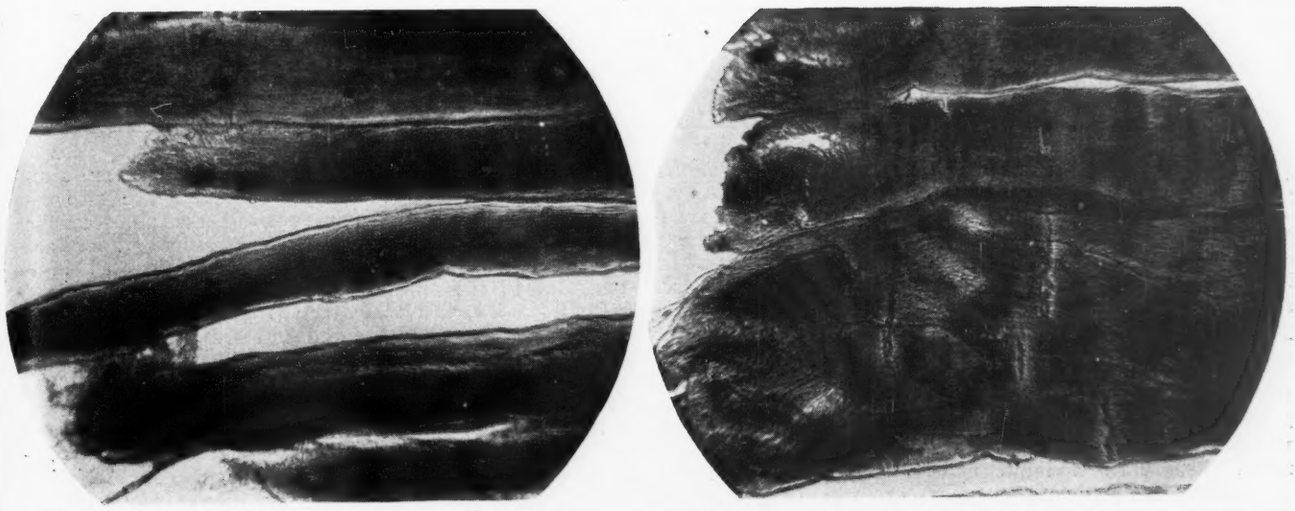
Freezing of the product while confined in molds or cans—termed indirect immersion—has several advantages over direct immersion. Calcium chloride brine, with its low freezing point, can be used and distortion avoided. However, the various indirect immersion systems require a great amount of labor to load and unload the forms or cans, to place them in and out of the brine, and to keep them thoroughly clean. If several sizes and shapes of product are to be frozen a large stock of cans and molds must be kept on hand; it is a laborious and expensive task to load them properly; and the cakes from such cans cannot be rectangular in their dimensions, because the cans themselves must be narrower at the bottom than at the top in order to facilitate the removal of their contents after the ice seal between the cans and their contents has



Whole dressed fillets are placed on this Monel metal conveyor and passed through cutting knives, thus yielding a standard size of product for refrigerating and packing



The frosting unit consists of flexible Monel metal belts between which the filleted fish pass continuously for quick freezing. The temperature is from 40 to 45 degrees below zero



Photomicrographs reveal the value of quick-freezing. LEFT—*Cells from quick-frozen haddock, perfect in every respect.* RIGHT—*Cells from haddock frozen in the ordinary manner, showing ruptures caused by ice crystals, resulting in waste when the fillet is thawed*

been broken. Moreover, such a system requires a large floor space and offers many opportunities for contamination of the product.

Another method of "quick freezing" employed in the United States is that of conduction from one side. Separate fillets are placed by hand upon metal plates, each plate being a part of an endless chain which travels in a trough of cold calcium chloride brine in a long refrigerated room kept at low temperature. The plates are not submerged in the brine while in the trough, but instead virtually float upon it and with the result that they are intensely cold. The fillets travel slowly around the interior of the room in about forty minutes, and by the time they have come to the end of the machine they are stone hard. Because products prepared by this method are frozen by conduction, and only on one side, it is practicable to produce only single thin fillets since the time necessary to freeze the product increases in proportion to its thickness.

"Quick freezing" by the Birdseye process differs in several important features from the open trough method. The product to be frozen is fed onto the receiving end of the lower of two Monel metal belts and passes into an insulated tunnel. The two belts grip the product firmly while it is in transit and relinquish it automatically at the delivery end of the apparatus. While the product is going through the tunnel, calcium chloride brine at about—45 deg. F. is sprayed on the upper side of the top belt and the lower side of the bottom belt, giving the effect of a continuous can immersed in a rapidly circulating, thoroughly chilled calcium chloride brine. There is an automatic device to keep the brine from penetrating between the belts and coming in contact with the product. The distance between the belts is automatically regulated by the thickness of the product itself. Freezing may be done continuously or in batches.

This is the product; but no picture can do justice to the appetizing appearance of freshly and quickly frozen Cello-Wrapped Fillets—solid blocks of fish in transparent wrapping, ready for shipment without further icing

This apparatus has certain unique advantages in that it requires a minimum of operating labor and turns out the maximum of frozen product with the least floor space requirement. Because there is nothing but the metal belts between the product and the extremely cold and rapidly circulating brine, freezing must be done very quickly with the quality of the frozen product correspondingly high. Capital investment is held to the minimum since the apparatus itself, without any auxiliary molds or cans, will handle practically any size or shape of marine product likely to be filleted.

Important also is the extreme elasticity of the Birdseye method—the almost limitless variety of kinds, shapes and sizes of products which may be fed into it without any manual adjustment or special auxiliary apparatus. Whole fish placed singly on the belts, single fillets of the smallest or largest size, paper-thin flounder fillets or huge halibut fletches, small fish dressed or not dressed or "panned" for freezing in blocks, individually wrapped cartons; all can be taken care of. All of these products can be fed to the machine as fast as they can be placed on the belts. Inasmuch as no brine can reach them they all emerge at the delivery end of the apparatus hard-frozen, clean, and of the desired shape. Fish that are to be glazed pass directly and automatically from the *froster* through the device for glazing and thence to the cold room.

ABSTRACTS · OF · CURRENT · LITERATURE

RANCIDITY IN FATS. W. L. Davies. *Industrial Chemist,* July, pp. 269-72. The time-rancidity curve for fats generally shows an induction period, during which the incipient oxidation is very slow and the rate increases but slowly. When the induction period is past the development of rancidity (as measured by amount of oxygen absorbed) follows a logarithmic curve. Before the end of this period the fat is still usable and marketable; after the faster oxidation sets in deterioration is rapid. Temperature, light, moisture, and acidity favor the development of rancidity: so also do traces of certain metals, sometimes present as fat-soluble soaps. Metal containers sometimes give trouble by losing minute amounts of metal to the fat. Micro-organisms are sometimes a direct cause of rancidity, particularly when nitrogenous matter is present. A test for estimating the tendency to turn rancid—the "oxidation potential"—of fresh fats is described. To prevent rancidity fats should, of course, be kept dry and cool, in the dark and as nearly acid-free as possible; but in addition to these precautions, the recent development of anti-oxidants for rubber and non-edible oils shows some promise that like compounds, suitable for the protection of edible fats and oils, may be developed on the basis of the work done by other industries having like problems but different products.

USES OF STEAM. Staff Report. *Industrial Gas,* July, pp. 20-1. Live steam can be used very effectively in the preparation and maintenance of food for serving in restaurants and hotels; but proper control of temperature and other conditions must be provided. Such control is rendered difficult by the necessity, particularly in the case of steam tables, of constantly dissipating the steam and supplying fresh water to the boiler. Other considerations which must receive due attention are the possibility that the use of water softening compounds in the boiler may lead to contamination of the food on the steam table, and the danger of over-cooking by use of unnecessarily high steam pressures. The problems of fuel and temperature (pressure) control are much simplified by the use of gas-fired boilers, with the automatic devices now available for controlling the gas and water supply rate and for maintaining constant steam pressure. Some installations of gas-fired boilers for cooking and for steam-table maintenance are described and illustrated, with discussion of the control devices used.

CANE JUICE EVAPORATION. René Weil. *Sugar,* July, pp. 335-7, August, pp. 384-5. (In Spanish.) Two evaporator installations for concentrating sugar solutions are described and illustrated. One is a quintuple effect, the other a quadruple effect. The diagrams show the flow of the juice, the temperature gradient from one unit to the next, and the use of two Petree-Dorr heaters, one for bringing 40 per cent sirup from 20 deg. C. up to 102 deg. C., the other for bringing 60 per cent sirup from 52 deg. C. up to 102 deg. C. Thermal calculations are given to show how the amount and pressure of steam necessary for each step in the treatment are to be estimated. Tables are given to show the calories per ton of cane, calories per minute, steam temperature and heating surface in each unit of the evaporators. On the basis of the figures cited, cost calculations are made.

GUR. Kasanji O. Naik. *Sugar,* July, pp. 319-20. Gur, as manufactured in India, is defined by the Indian Sugar Committee as natural cane juice concentrated to solidification with no treatment for purification beyond addition of a simple clarifying agent and the removal of scums. It is preferred to sugar in many recipes, on account of its characteristic aroma; and it is said to be rich in vitamin B. The essential properties are purity, color (which should be yellow rather than reddish) and keeping quality. Lime, added to harden the product, tends to darken the color. A high content of invert sugar is detrimental to keeping quality. The composition varies widely, according to the variety of cane and the conditions of production. Sucrose ranges from 62 to 87 per cent, glucose 5 to 20 per cent, water 5 to 15 per cent, and ash up to 6 per cent or even more. Experiments are under way with a view to producing a hard, light colored gur which will not absorb water and will not darken with time. It has been found possible to obtain the hardening effect of lime, without the attendant discoloration, by removing the excess lime in the later stages of boiling (carbonation); but as gur production is mainly a cottage industry, general adoption of this idea is not to be expected. Statistics of the industry are cited.

FRUIT SIRUPS. *Industrial Chemist,* July, pp. 279-83. Fruit squashes, popular in Great Britain, are made by properly controlled compounding of the expressed juice of a citrus fruit with a sugar sirup, the flavor, except in the case of lemons, being adjusted by adding citric acid. The favorite preservative is potassium metabisulphite. Laboratory control tests include gravity, acidity and taste. Fruit sirups from berries, *et al.,* have a similar method of manufacture, but with the necessity of efficient filtration. Carbonated water and natural or compounded mineral waters are also essential products of the non-alcoholic beverage industry. Photographs are shown of the equipment used in a modern plant for expressing juices, mixing with sugar sirup, producing CO_2, carbonating liquids (low- and high-pressure methods) and grinding ginger with sugar. An Enzinger filter press, using paper pulp as filter medium, is a feature of the equipment.

SUGAR CHEMISTRY. B. Helferich. *Zeitschrift für angewandte Chemie,* Aug. 11, pp. 871-5. Trityl ether, the new Beilstein name for triphenylmethyl ether, is a reagent which is opening up many new possibilities in sugar chemistry, both for characterization of sugars and their structure, and for synthesis of new and old sugars. That is, trityl halides react with primary alcohol hydroxyls to form ethers, and so can be used to characterize sugars by their primary hydroxyls. This, however, is not the most important application of the trityl ether reaction; by a suitable sequence of reactions and coupling disaccharides, trisaccharides and tetrasaccharides can be synthesized. Thus, gentiobiose was both synthesized and characterized with the aid of trityl ether reactions; several naturally occurring sugars and glucosides have been characterized.

PROHIBITED FOOD COLORS. A. R. Jamieson and C. M. Keyworth. *Analyst,* August, pp. 418-23. Of the coal tar dyes prohibited for use in foods and beverages, microcrystalline tests can be used to identify picric acid, Victoria Yellow, Martius Yellow, Aurantia and Aurine. For picric acid the preferred reagent is berberine sulphate; for Martius Yellow, berberine sulphate or gold chloride; for Aurantia, phosphotungstic acid; for Victoria Yellow, HCl and Wijs solution; for Aurine, a lake made with chrome alum. A procedure is described for applying the tests to an unknown, and photomicrographs of the characteristic crystalline precipitates are shown.

FLUORESCENCE LAMP. Alexander B. Marconnay. *Chemische Fabrik,* August 15, pp. 488-90. The Jaenicke mercury vapor lamp, which does not use a vacuum, is useful for examination of the fluorescence behavior of numerous materials. It is adapted to this purpose by a black glass U. V. filter, which shuts out the rays of visible light. The materials which show a characteristic fluorescence in ultraviolet light are so numerous that there are many fields of usefulness for the fluorescence lamp. Important among these are the analysis (characterization and detection of impurities or adulterants) of fats, oils

and other foodstuffs and of sugars and their products. The lamp is described and illustrated with photographs and diagrams.

FLOUR AND BREAD. M. P. Neumann. *Zeitschrift für angewandte Chemie,* July 21, pp. 792-4. Recent advances in the technology of flour production and baking are reviewed. In flour production there is little to report except the controversy, still unsettled, over the merits of the wet process of bran removal. Baking has shown more progress, e.g. in the development of tests for baking quality and in the application of pH control, viscometry and measurements of such properties as surface tension, heat of swelling, molecular magnitude and molar combining power. Malting, the use of phosphates, and sulphates, chemical bleaching and dough fermentation have also contributed their share to baking technology in the past few years.

REFRIGERATION. A. Walter. *Zeitschrift für angewandte Chemie,* July 21, pp. 797-801. Refrigeration is discussed as a factor in food production and distribution. The compression and absorption types of machine are discussed, principal emphasis being on compression machines as the proper type for large installations. Specific applications in brewing, meat packing, cold storage warehousing, and the storage and transportation of fish, dairy products, margarine, fruit, confections, beverages and oils are discussed. Illustrated with photographs and a diagram of a compression refrigerating machine.

CLARIFICATION. M. Rüdiger and E. Mayr. *Zeitschrift für angewandte Chemie,* July 21, pp. 809-12. The clarification of turbid liquids, such as wines and other beverages, by the gelatin flocculation method does not depend on formation of a compound of gelatin and a tannin or the like, but on particle size, the amount and sign of electrical charges on the particles, and the acidity. It may be said in brief that the flocculation is a result of adsorption phenomena governed by electrical conditions. In practice, the optimum conditions of gelatin concentration, temperature, pH and so on should be ascertained and followed as closely as possible.

FLUORESCENCE. Max Haitinger, Hans Jörg and Viktor Reich. *Zeitschrift für angewandte Chemie,* July 21, pp. 815-9. A Hanauer analytical quartz lamp, with uviol glass light filters, was used to study the fluorescence behavior of fats and oils. Solids were observed on filter paper of black glazed paper; liquids on filter paper or in any of several kinds of non-fluorescent glass. The products investigated were butter and its artificial substitutes, lard, cocoa butter and a number of vegetable oils, including olive, peanut, maize, castor, sunflower, soy bean, cottonseed and hazel nut oils. Tabulated results show the characteristic fluorescence appearances of the materials themselves and in solution, by reflected and by transmitted light. Observations in capillary tubes are also reported.

· CRITICAL · BOOK · REVIEWS ·

OILS, FATS AND FATTY FOODS. By E. Richards Bolton, F.I.C., F.C.S. With a chapter on Vitamins by J. C. Drummond, D.Sc., F.I.C. P. Blakiston's Son & Co., Philadelphia (printed in Great Britain). Price, $8.

Due to the large number of books on the same subject in almost any specialized field authors often begin a preface with a statement to the effect that the reading public can hardly but wonder why the author regards it as justifiable to add his book to the already crowded field. The author of Oils, Fats and Fatty Foods (second edition of Fatty Foods by E. Richards Bolton and Cecil Revis) makes no such statement and, to the reader acquainted with this field a perusal of this new edition will make it evident that its existence is fully justified by its unique character and its method of attack of the subject matter treated, both new and old. The book is plainly intended not only as a text and general reference for some of the commoner analytical methods for animal and vegetable fats and oils but as a very practical guide in solving many of the daily problems in determining the nature and purity of edible fats and oils intended for many uses. The element of utility becomes evident early in the book and continues to pervade the entire volume.

Following two introductory chapters comes one on analytical methods and then another devoted solely to their interpretation. This chapter on the interpretation of results and the methods of reasoning used in attacking some of the more difficult of the analytical problems almost daily encountered in the edible fat industries indicates how well aware the author is of the flexible attitude of mind which must be preserved in translating analytical data into action. Then, after a short chapter on the industrial production of vegetable oils and fats, comes one on butter and margarine and another on animal fats, fish and marine oils—all very concise and containing essentials a busy man in this field must know. There follows a chapter on vegetable oils and fats constituting over one third of the entire book. A very concise botanical classification is adhered to and a vast amount of valuable information is contained in this chapter of 158 pages. What may appear to be occasional unnecessary information on oils from relatively obscure sources is valuable indeed to have in these days when so many of the once little-used oils are finding industrial application. This chapter alone is a valuable reference to a field on which volumes have been written, and it is up to date. Also it is indexed separately.

The chapter on hydrogenation presents a brief review of the recent work on the new Bolton and Lush method of continuous hydrogenation which has been published more fully in the Journal of the Society of Chemical Industry during the past few years. The remaining chapters are on rancidity, preservatives and coloring matters; cocoa, chocolate and milk chocolate; feeding stuffs; milk, and finally a chapter by Dr. J. C. Drummond, eminent English authority on fat-soluble vitamins, on the nutritive value of edible oils and fats with particular reference to their vitamin content. In short it may be said that, besides what would normally be expected in such a text, the author presents much that is new in an aggressive, concise style. The book is well worth owning.

Only one or two typographical errors could be detected—"interrupted" on page 78 was probably intended to be "interpreted." The style of the print used, the shape of the page, the cuts of apparatus, the binding, etc., seemed to detract somewhat from the readability of the book, at least as far as the reviewer was concerned, in that they appear severe and a bit uninviting to the eye. H. W. VAHLTEICH.

COPRA AND COCOANUT OIL. By Katherine Snodgrass. Food Research Institute, Stanford University. California. April, 1928, 135 pages.

This is a valuable contribution to the economic and statistical side of the subject, bringing together in a very interesting form, in a compact volume, the information which heretofore has been greatly scattered and, more often than not, couched in some language other than English.

The book deals with the subject largely from the statistical standpoint and shows the place of cocoanut oil among the fats followed by a brief description of the cultivation and preparation of cocoanut products. Much information is given regarding the world production of cocoanut oil and the quantities obtained from different localities. One chapter is devoted to the outlook for expansion, with special reference to the Philippine Islands. The chapters on International Trade, Market Position and Outlook and the Utilization of Cocoanut Oil in the margarine and soap industrise are very complete.

Not the least important portions of the book, are the bibliographical note and the appendix; the latter contains many valuable tables. This is a book which should be on the desk of everybody who is engaged in the handling of cocoanut oil. DAVID WESSON.

THE FATS AND OILS. A General View. By Carl L. Alsberg and Alonzo Taylor. Food Research Institute, Stanford University, California. February, 1928, 100 pages.

The Food Research Institute of Stanford University has started a series of fat and oil studies, as follows:

No. 1. The Fats and Oils. A General View.
No. 2. Copra and Cocoanut Oil.
No. 3. Inedible Animal Fats.
No. 4. The McNary-Haugen Plan as applied to Corn and Hogs.
No. 5. History of the Lard Compound Industry.

The first in the series now at hand gives splendid promise of what may be expected from the other volumes. It is not only very interesting reading, but is full of information of value to the scientist and layman. It is highly commended to everybody interested in the subject. It is a book which should be of special use and interest to business executives engaged in the handling of fatty products. DAVID WESSON.

CANDY DISTRIBUTION IN THE UNITED STATES. By Rupert L. Purdon, Chief of the Confectionery Section, Foodstuffs Division, U. S. Department of Commerce, being No. 23 of the Domestic Commerce Series, published in April, 1928.

This 50-page pamphlet is of real interest to all producers of foods, despite its title. It is the first instance of governmental inquiry into peace-time distribution of an article of food; it was undertaken at the request of the confectionery industry and accomplished with the aid of a dozen leading candy makers and their able national secretary, Walter C. Hughes; it settles in the affirmative the moot point of the continued increase in the consumption of confectionery; it indicates that there is much—perhaps too much—sales effort expended by candy manufacturers in states far distant from the factory; it calls attention, but without comment, to the relatively heavy transportation charges involved in the transportation of candy from factory to outlet. Many other major points are discussed, authoritatively, and in able fashion. R. G. GOULD.

FOOD PRODUCTS, THEIR SOURCE, CHEMISTRY, AND USE. By E. H. S. Bailey and Herbert S. Bailey. Third Edition, revised. P. Blakiston's Son & Co., Philadelphia, 1928. 563 pages. Price, $2.50.

As a general reference work for men in professional contact with foodstuffs no less than as a fund of information to interested receptive laymen, a book such as this assumes a wide utility because of its inclusive scope. Its present new appearance represents an extensive revision—or better, supplementation — of material that had already counted a deservedly large number of readers.

Since the last previous edition appeared some years ago, the authors were now obliged to incorporate in their work many salient advances made during the interval: the discovery of vitamins and new technologic methods, as in the drying of milk, represent important examples of this progress. Happily, this task has been undretaken unstintingly, a large majority of the pages being products of the amending hand. Happily, too, this amending hand continues to cultivate a casual rather than a textbook manner—a circumstance which, combined with balanced judgment, is far more inviting to a reader than the tone of partisan earnestness so frequently encountered. Often a final decisiveness on a disputed point may seem wanting for this reason; but suspended judgment is here fortunately an adjunct of presented, but insufficient, evidence.

Typographic carelessness is a somewhat annoying, albeit subordinate, feature of the book. Grave errors are absent, but one is left to speculate, for example, on the nature of "orangic salts" in the chapter on Oranges, and on the authors' true preference in "although" and "altho." Then, too, Western peoples would scarcely indorse the combined statements, "rice . . . is said to form the principal food of one-half of the human race" and "[millet] . . . is estimated to feed one-half of the inhabitants of the earth." On the whole, however, a thankful general reader of this comprehensive work can harbor the regret only that, in the third revision, there has been another drastic reduction in the discussion of alcoholic beverages, where, especially now, an expansion could have offered such a gratifying subsidiary service. R. KOCH.

· GOVERNMENT · PUBLICATIONS ·

Documents are available at prices indicated from Superintendent of Documents, Government Printing Office, Washington, D. C. Send cash or money order; stamps and personal checks not accepted. When no price is indicated pamphlet is free and should be ordered from bureau responsible for its issue.

Regulations for Warehousemen Storing Cold-Pack Fruit. Service and Regulatory Announcement No. 111, Bureau of Agricultural Economics. Applies to licensed public warehouses engaged in this type of business, fixing definitions for "cold-pack fruit" describing license, bond, receipt, fee, and other rules to govern transactions which come under the United States Warehouse Act. These regulations were issued originally in mimeographed form during May of this year.

Flour Markets of South America. Bureau of Foreign and Domestic Commerce Trade Information Bulletin 570. 10 cents. Resume indicating present sources of wheat and flour, business prospects for United States concerns, and local customs affecting the trade.

Varieties of Cheese: Descriptions and Analyses, by C. F. Doane and H. W. Lawson. U. S. Department of Agriculture Bulletin 608. 10 cents. Gives information regarding known varieties from all parts of the world, including full technical description and typical analyses.

Factors in the Inception and Development of Fusarium Rot in Stored Potatoes, by Freeman Weiss, J. I. Lauritzen, and Philip Brierley. U. S. Department of Agriculture Technical Bulletin 62. 15 cents. Gives important information for any plant using potatoes as a raw material.

Some Factors Affecting the Demand for Milk and Cream in the Metropolitan Area of New York, by H. A. Ross. U. S. Department of Agriculture Technical Bulletin 73. 15 cents. An elaborate and detailed study, including comprehensive statistics. Although directly applicable only to New York City territory it is of suggestive value for concerns interested elsewhere or concerns competing for milk and cream supply with city dairy systems.

Preservation of Peaches for Use in the Manufacture of Ice Cream, by Charles W. Culpepper, Joseph F. Caldwell, and R. C. Wright. U. S. Department of Agriculture Technical Bulletin 84. 5 cents. Résumé of experiments and recommendations of methods for adequately preserving fruit flavor in stored peach pulp.

The Commercial Production of Sauerkraut, by Edwin LeFevre. U. S. Department of Agriculture Circular 35. 10 cents. A review of the present industry and recommendations regarding factory methods, sanitation, and testing, with brief bibliography.

The Value of Inert Gas as a Preventive of Dust Explosions in Grinding Equipment, by Hylton R. Brown. U. S. Department of Agriculture Technical Bulletin 74. 5 cents. This bulletin gives an elaborate discussion of one phase of food plant safety; see article by D. J. Price elsewhere in this issue of Food Industries for a more general presentation of the subject.

Marketing Eggs, prepared by Rob. R. Slocum. U. S. Department of Agriculture Farmers Bulletin 1378. Primarily addressed to egg producers, but significant also for egg product manufacturers and to a lesser degree for egg product users.

Safety Code for Mechanical Power-Transmission Apparatus. Bureau of Labor Statistics Bulletin 463. 10 cents. The text, with illustrations, of the national standard regulations which have been prepared under the auspices of the American Engineering Standards Committee, a joint effort of casualty in-

surance representatives, public officials, and mechanical engineers. Valuable suggestions are included regarding safeguarding equipment, applicable in all types of food plants.

Sugar Cane Variety Tests in Louisiana During the Crop Year 1926-27, by R. D. Rands, Sidney F. Sherwood, and F. D. Stevens. U. S. Department of Agriculture Circular 36, August, 1928.

A report summarizing the second season's comparative plot tests with mosaic-tolerant sugar canes in Louisiana and suggesting three new varieties of cane, P.O.J. 36, 213, and 234, "as the surest means for relieving the distressing financial conditions of the industry."

Cocoa in West Africa, by Leonard J. Schwarz. U. S. Department of Commerce. Trade Promotion Series, No. 68. 15 cents.

A report of studies made in West African countries, where one-third of the cocoa coming to America originates, for the purpose of ascertaining the causes of moldy cocoa beans, covering chiefly the technic of harvest, fermentation, drying, and shipping; all from the standpoint of answering the question of how the beans become moldy. The lack of scientific knowledge of the fundamentals of the fermentation of cocoa is stressed as is the failure of natives to comprehend the purposes of drying properly and of protecting the dried product from rewetting.

Government Master Specifications, Promulgated by the Federal Specifications Board, Complete to January 1, 1928. Bureau of Standards Circular 319. This list, with mimeographed supplements gives both alphabetical and numerical listing of all types of specifications used by the Federal Government issued under the auspices of the Federal Specifications Board, including a very large number of specifications for processed or manufactured foods. The specifications themselves are available from the Federal Specifications Board, which should be addressed care of the Bureau of Standards, Washington, D. C.

Yearbook of Agriculture, 1927. U. S. Department of Agricultural. $1.50. The usual general review with elaborate summary of agricultural statistics. Trends in the use of agricultural products are discussed in a large portion of the book, devoted to technical articles under the heading, "What's New In Agriculture."

Commerce Yearbook, 1928. Vol. I—United States. U. S. Department of Commerce. $1.25. Annual statistical and trade review with special reference to import and export trends of both raw materials and industrial products. Approximately 100 pages of the book are devoted exclusively to agricultural products and food stuffs.

Animal and Vegetable Fats and Oils. Bureau of the Census. 5 cents. A statistical statement prepared under the supervision of Harvey J. Zimmerman, Expert Special Agent, giving by quarters for the calendar years 1926 and 1927 production, consumption, imports, exports, and stocks for a wide variety of both edible and inedible oils and fats. This is one of the regular numbers in the statistical series of the Bureau of the Census.

· SELECTED · PATENTS ·

Yeast Stimulant

Theodore B. Wagner, Brooklyn, N. Y. No. 1,680,827. Aug. 14, 1927.

A yeast stimulant permits the use of less yeast than would otherwise be required or, without altering the baker's formula, it may shorten the necessary fermenting period. In the past there have been used for this purpose mineral salts such as calcium sulphate, potassium bromate, etc. Wagner makes a yeast stimulant from corn by steeping it in water at 120 deg. F. for 48 hours. The steep water, either concentrated in vacuo or at normal density, is mixed with wheat flour, corn starch, or other amylaceous material.

The mixture of steep water and the carrying vehicle is next dried, pulverized, bolted, and placed in commercial packages. An advantage of this product, it is claimed, lies in its purely organic nature and the fact that it contains lactic acid which has a definite value in bread making.

Bottle Washing Machine

Roy A. Manning, Rutland, Vt., assignor to Manning Manufacturing Co., Rutland, Vt. No. 1,680,106. Aug. 7, 1928.

A new type of bottle washing machine has been invented by Roy A. Manning, Rutland, Vt. Bottles are carried in cases in an inverted position through a jet box. The lower part of the machine is a series of compartments in which either alkali water or rinsing water may be contained. As the bottles move through the jet box, a spray of the particular liquid over which they are passing is introduced from below and from above which thoroughly cleanses the bottles. A feature of the invention is the fact that the reservoirs below have bottoms arranged in such a way that all foreign material accumulating in them is easily removed.

Receptacle Closure

Leslie R. N. Carvalho, Toledo, Ohio, assignor to the Closure Service Company, Toledo, Ohio. No. 1,680,763. Aug. 14, 1928.

This is a type of closure combining the seal and the bottle cap in a single item, such as might be used for a catsup bottle. Accidental or casual removal is prevented by having the lower edge flanged inwardly over a bead on the neck of the bottle. The lower portion is scored and cut in such manner that it may easily be torn open with the fingers when it is desired to open the bottle. The upper or main part may then be used as a temporary seal.

Cream Pasteurizer and Deodorizer

Fredrick Louis Armitage, Devonport, New Zealand. No. 1,680,720. Aug. 14, 1928.

Simultaneous pasteurizing and deodorizing of cream may be carried out in this apparatus. Essentially it consists of a modified vacuum-pan equipped with a stirrer and scraping device. The contents of the pan are heated by a jacket instead of tubes or calandria, the jacket being divided into two parts, one of which is for heating and the other for cooling.

Cream is started to boil at a very low temperature under high vacuum and gradually brought up to pasteurizing temperature, which generally is regarded as 30 minutes at 145 deg. F., followed by cooling. Boiling may be continued or not, dependent upon the degree of vacuum in the apparatus.

The rapid ebullition carries away foreign odors; for example, that imparted to milk by turnips eaten by the cow. Precipitation on the walls of the vessel is prevented by the scrapers.

When treated in the above manner, it is claimed that first quality butter may be produced from cream that otherwise would make an inferior butter.

Baking Oven

John E. Pointon, Peterborough, England, assignor to Baker Perkins Company, Incorporated, New York, N. Y. No. 1,678,076. July 24, 1928.

Pointon has designed a continuous oven in which a chain conveyor makes four separate horizontal passes, being guided around large sprockets. On this chain are hanging shelves on which goods are placed for baking. The path of travel roughly approximates the entire exterior contour of a letter U laid on its side, or a horseshoe. At the open end of the horseshoe are doors for setting or removal of the product.

The speed of the belt determines the maximum baking time and for shorter periods of time the goods may be placed on the conveyor at points in advance of

the initial opening through doors that open close by. Thus three distinct baking periods are simultaneously possible with a single oven operated at a constant speed.

Advantage is taken of the lower specific gravity of steam to the end that the product while baking may be subjected to heat in either a steam laden or dry air atmosphere; and all in the same oven. Heating may be accomplished by suitable elements, either gas, steam or electric.

Extracting Cocoa Butter

Ivan S. Hocker, Philadelphia, Pa., assignor to The Hocker Corp., Philadelphia, Pa. No. 1,680,943. Aug. 14, 1928.

In the separation of fat from vegetable matter there are two general processes available, namely, mechanical expression or extraction. The first does not give complete recovery while the second is not always suitable for edible fats because the solvent may communicate to it an undesirable flavor. This patent describes a third and new method which is applied to cocoa.

Shelled cacao beans contain about 50 per cent fat, 10 per cent starch, and 15 per cent albumen. The starch of the cacao bean consists of the most minute granules of any starch and is a quality that accentuates the well known affinity of starch for fat that renders expression of the fat an incomplete process. Hocker cooks finely ground roasted beans in water, dissolves the starch by malt, and ferments out the sugar by yeast. The bubbles of carbon dioxide rising to the surface of the cocoa mash carry the emulsified oil globules with them and when the process is complete the fat is chilled and then easily removed. Details of procedure are given in the patent.

Glycerine By Fermentation

James W. Lawrie, Wilmington, Del., assignor to E. I. du Pont de Nemours & Co., Wilmington, Del. No. 1,678,150. July 24, 1928.

For many years it has been known that glycerine can be obtained in varying amounts from the fermentation of sugar by yeast. Nerberg and others have shown that the amount of glycerine formed would be much greater if the mash contained sodium sulphite. Amounts up to 40 per cent of the weight of the sugar have been used. Eoff found that glycerine production was largely increased by the addition of alkaline salts. When blackstrap molasses mash containing 15 per cent of fermentable sugars is used 4 per cent of the weight of the mash should be sodium carbonate (soda ash).

Lawrie has found that soda ash may be replaced by the ash obtained by burning the foots after the alcohol and glycerine have been distilled off and this patent relates to his discovery. Yields of glycerine up to 27.1 per cent of the fermentable sugars, and alcohol from the same fermentation amounting to 39.4 per cent of the fermentable sugars, are reported. Yeast No. 16 of F. A. McDermott, U. S. Patent No. 1,551,997 is the preferred fermenting organism.

Wrapping Machine

H. H. Metcalf, Battle Creek, Mich., assignor to Battle Creek Wrapping Machine Co., Battle Creek, Mich. No. 1,677,924. July 24, 1928.

Structural improvements are embodied in Brownell's patent No. 1,416,165, May 16, 1922, by means of which flaps of the wrapper on a loaf of bread or similar irregular object may be folded neatly and uniformly. Easy adjustment to articles of varying dimensions may be quickly made thus rendering it unnecessary for a baker to provide more than one machine for wrapping different loaf sizes.

Copies of Patents

Complete specifications of any United States patent may be obtained by remitting 10c. to the Commissioner of Patents, Washington, D. C.

Photostatic copies of foreign patents may be obtained at the same address, prices on application.

Refrigerating System

H. W. Tohtz and K. L. Bonnell, St. Louis, Mo. No. 1,678,172. July 24, 1928.

This invention relates particularly to those systems wherein the refrigerant is sprayed into the air to be cooled, such as are employed in chilling rooms of meat packing houses. The object to be attained is, primarily, cooling the air and, secondarily, circulation of the air and prevention of marked dilution of the refrigerant by moisture condensed in it.

Refrigerating brine is sprayed in a conical spray inside of large thin metal tubes hung in vertical position. The movement of the spray forces air downward and it escapes, thoroughly chilled, in a separating device at the bottom. If the whole system is affixed at the proper height the warmer air which always collects near the ceiling is drawn into the tubes and cooled. Moisture will collect on the outside of the tubes and the amount of dilution of the refrigerant thus materially reduced.

Cream Whipping Process

Charles E. North, Montclair, N. J., assignor to The Milk Oil Corporation, Wilmington, Del. No. 1,678,477. July 24, 1928.

In a previous patent, No. 1,485,792, North described a combination of apparatus for carrying out a process of recovering oil from milk in which cream is separated centrifugally from whole milk, then washed with water to eliminate casein, then cooled, agitated and mixed with warm water and again separated to remove more casein and water.

The present patent covers a process of agglomerating cream by whipping or agitating, taking care that the cream is not churned into butter, for by varying the rate of flow and speed of the whipper there may be obtained, as desired, thick cream, agglomerated cream, or butter.

The apparatus consists of two series of whipping blades rotating in opposite directions, the cream being fed up from the bottom. The whipped cream comes out in a semi-solid condition with little or no fluidity. It is not frothy nor fluid. The purpose of the invention is to produce butter fat that is washed entirely free from non-fat substances and yet not churned into butter.

Evaporating Apparatus

Ermin Pokorny, Prague, Czechoslovakia

No. 1,677,987. July 24, 1928.

Various types of evaporating apparatus have been proposed to secure more rapid circulation and more effective separation of entrained liquid from the escaping vapors. In evaporators of known type the movement of the liquid is produced by the lifting action of steam bubbles, while in this apparatus the movement of the liquid is brought about by steam, emanating from the generator itself, that blows the liquid the whole length of the tubes with the same speed as the ascending steam.

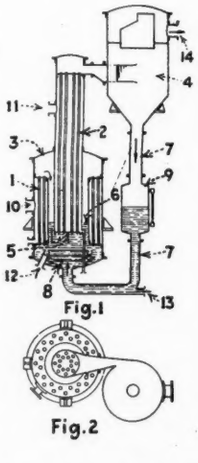


Fig. 1

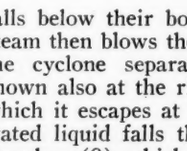


Fig. 2

By referring to Fig. 1 the method of operation can be easily visualized. The evaporating body is composed of an external heating chamber (1), surrounding an internal heating chamber (2), each unit being independent of the other. Hot steam enters at (10) and (11). As steam is generated in the liquid in (1) it gathers in chamber (3), forcing liquid up into the tubes of (2) so that its level falls below their bottoms at (5). The steam then blows the liquid upward into the cyclone separator (4), which is shown also at the right of Fig. 2, from which it escapes at (14). The concentrated liquid falls through pipe (7) to chamber (9) which is of proper capacity to compensate for the rise of liquid in the tubes of (2).

Concentrated liquid feeds back into the evaporator proper through its bottom, deflecting against (8). Fresh liquid is introduced at (12) and concentrated liquid is drawn off at (13). Another design is given for liquids requiring exceptionally rapid circulation in which two different liquids may be evaporated simultaneously if desired, provided the vapors of one do not harm the other liquid.

· NEWS · ITEMS ·

Domestic Sugar Producers Form Important Alliance

Believing that the domestic demand for sugar is great enough to warrant expectation of satisfactory margins of profit for all domestic producers of this product, whether it be from beets, cane or maple trees, provided higher tariffs on foreign raws may be obtained, the Domestic Sugar Producers Association has invited the Associated Corn Products Manufacturers to join with them for the common good. In a recent meeting in Chicago, presided over by Ernest A. Burguieres, the Board of Trustees of the Domestic Sugar Producers' Association voted to elect the Associated Corn Products Manufacturers to its membership, thus securing a union of purpose of producers of corn sugar and corn syrup with the former organization. Its membership now includes, in addition to corn sugar producers, the beet sugar producers of seventeen states of Continental United States, from Ohio to the Pacific slope; the sugar cane growers of Louisiana, Georgia and Texas (represented in the American Sugar Cane League); and the sugar cane producers of Hawaii and Porto Rico.

Embargo on Canadian Milk Lifted by U. S. Officials

On September 4, 1928, our embargo against the importation of milk and milk products from Montreal, which has been in existence since March 25, 1927, was officially lifted. The Food, Drug and Insecticide Administration of the United States Department of Agriculture, which enforces the federal food and drugs act, placed the embargo under authority of that law and upon receipt of advice from the United States Public Health Service that the typhoid situation existing in Montreal and its vicinity early in 1927 rendered milk and milk products from that section potentially dangerous to the health of our people.

The original embargo covered milk produced at all points within 200 miles of the city of Montreal. As health conditions improved in the territory surrounding that city the extent of the embargoed territory was reduced to include only the city of Montreal and its immediate vicinity. On August 31, 1928, the enforcing officials were notified that the Public Health Service had completed a survey of the sanitary protection now accorded milk and milk products in Montreal and vicinity and that in view of the increased force engaged in the sanitary control of milk, which now compares favorably with that in large American cities, and of the reduced prevalence of typhoid fever, there appears to be no consistent reason for the continuance of the embargo.

In addition to the surveillance maintained over imported milk and milk products under the federal food and drugs act, all importations of milk and cream are subject to supervision under the recently enacted federal import milk act, also administered by the Food, Drug and Insecticide Administration.

Ice Cream Cans May Be Standardized

Definite plans have been made for an exhibit of the wide variety of types and sizes of ice cream cans now manufactured as a portion of the meeting of the International Association of Ice Cream Manufacturers which will be held in Cleveland, Ohio, during the week of October 18. Several conferences have been held on the question of can standardization, and tentative recommendations have been made by a joint committee on simplified practice working in co-operation with both can and ice cream manufacturers. Under the policy of the Simplified Practice Division of the U. S. Bureau of Standards, such program to be effective must be made generally acceptable, but must remain voluntary. Hence, no steps will be taken until after the forthcoming meeting so that all interested parties may thoroughly familiarize themselves with present can sizes, and with the proposal which the committee has made.

The proposed simplification program contemplates five standard types of ice cream cans. A high-type and a low or squat-type would be provided for both 5 gallon and 2½ gallon capacities, and a high type only for the one gallon cans. It is proposed that there be standard dimensions for each type of can, including height and diameter dimension limits. It is believed by those who are in charge of this project that such standardization as may be finally adopted with the co-operation of manufacturers, distributors, and users, will eliminate much of the present confusion which results from the unwarranted diversity in type and size of cans now used. A simplification program will also, it is forecast, greatly lower the cost of can manufacture.

COMING EVENTS

OCTOBER

1-3—Annual Exposition of Candy, Ice Cream and Allied Industries, New York City.
2-4—Bread and Cake Bakers Association of Canada, Toronto.
8-12—Annual meeting, American Gas Association, Atlantic City.
11-13—International Association of Milk Dealers, Cleveland.
11-13—International Association of Dairy and Milk Inspectors, Chicago.
15-18—International Association of Ice Cream Manufacturers, Cleveland.
15-20—Dairy Industries Exposition, Cleveland.
19-24—Annual Convention, Institute of American Meat Packers, Atlantic City. (Meeting with Conference of Major Industries in New York, Oct. 24.)
24—Conference of Major Industries, Columbia University, New York City.

NOVEMBER

3-10—Pacific International Dairy Products Show, Portland.
12-16—Annual Convention, American Bottlers of Carbonated Beverages, Detroit.
19-24—Second International Conference on Bituminous Coal, Pittsburgh.
19-24—Pacific Slope Dairy Show, Oakland.
21-22—Wisconsin Cheese Makers Convention, Green Bay.
Western Canners Association, Chicago.

DECEMBER

3—Power Show, New York City.

New Sugar Cane Varieties Found in New Guinea

After three months of exploration by airplane, by canoe, and on foot in the tropical districts of Papua and New Guinea, where primitive tribes of pygmies and head hunters abound, Dr. E. W. Brandes of the United States Department of Agriculture has notified the department that his party has concluded its search for disease-resistant varieties of sugar cane. No less than 167 varieties of sugar cane have been gathered in the native home of the plant, all of which will be used in tests and for interbreeding in the department's experimental plats devoted to the development of sugar-cane varieties resistant to insects and to damage by mosaic and other diseases.

The party collected one new species of sugar cane—a hard, straight cane, growing to a height of nearly 33 ft. Cuttings of each variety obtained are to be shipped to the United States in refrigerated rooms of steamers. On arrival at San Francisco they will be shipped to Washington by express for growth under observation in the department's sugar-cane detention greenhouse at Arlington Farm. Duplicate cuttings are being planted at Sydney, Australia, as a precaution against possible loss or death of cuttings during shipment.

The expedition to New Guinea was determined on after the favorable showing made by the new P.O.J. varieties introduced into Louisiana by the department. These varieties were hybrid canes produced at the Dutch experiment station in East Java; a fact suggested by the third of the three rather cryptic initials used in describing them. The

new P.O.J. varieties have proved of great value to the sugar-cane industry, but it is hoped that the new varieties which the Brandes party discovered will prove to be even more resistant to diseases and insects, and will enable breeders to develop strains still more desirable for culture in the United States.

Economic Factors Playing Important Part in Welfare of Food Producers

By Paul Wooton
Washington Correspondent
Food Industries

BY PROMISING to reserve the domestic market for the farmer the Republican party has embarked upon a new application of its tariff policy which promises to be far-reaching in its effects.

Possible Tariff Relief

In view of the fact that each party is pledged to revise the tariff an extra session of Congress, for that and other purposes, undoubtedly will be called to convene in April. As the erstwhile "free trade" Democratic party has promised to employ the tariff to an extent it never has undertaken before, it is clear that more and higher duties on many agricultural products are in prospect.

Just how the phrase "reserve the domestic market for the farmer" is going to be interpreted remains to be seen. Some are of the opinion that the Republicans will be content with duties on commodities grown in this country, thus protecting the farmer sufficiently to enable him to produce. Others think the Republicans would go further under the language of the platform and protect farmers against food products which are not grown in this country, but which compete with home-grown foodstuffs. This principle already has been applied in the present law in connection with coal tar products.

When imports of foodstuffs are reduced to a calory basis, it is pointed out, they nearly equal our exports. Bananas, for instance, come in duty free. Although they are not and cannot be raised in this country, it is argued that the 2,570,208,750 pounds of bananas which came into the country in 1927 must have displaced an enormous amount of domestic food. Under any such arrangement agriculture would get more protection than any other industry. The Republican theory of tariff making previously has been to insure equalization. The desire of both parties is to aid agriculture in securing a more prosperous status. It is recognized that agriculture is in a position differing from the manufacturing industries, in that imported foodstuffs reduce by that amount potential consumption of all food.

The domestic sugar industry has been quick to see an advantage for itself in the effort to use the tariff in securing agricultural relief. Were the duty on that product gradually increased, it is argued, farmers unable to compete in the world wheat market, for instance, well could take up the growing of sugar beets or cane. With the home market for those agricultural products so reserved for the American farmer, enough farmers could be profitably employed to reduce the output of other commodities to the extent of domestic demand and to eliminate the surplus which now must be exported.

The revision of the tariff also carries with it the practical certainty of new provisions to cover the rapidly increasing imports of fresh vegetables. This type of importation is setting up serious competition with the canning industry, and indirectly with the American farmer who sells a part or all of his output to the canner.

Better Statistical Data Needed

Because of the increase in out-of-season imports the canning industry is contending with large surpluses. A bad feature of the situation is that lack of statistics makes for great uncertainty as to the exact amounts of these surpluses. The first attempt ever made on behalf of the industry to gather stock figures was made last year by the Food Division of the Department of Commerce, which collected the data on corn, peas, and tomatoes. The industry itself recognizes, as never before, that it must have complete statistical information, and that its activities must be revamped to a certain extent to meet the competition of fresh commodities and to prevent overproduction. In the consideration of economies attention now is being given to the elimination of excess variety in containers. For example, there are eighty-one sizes of No. 1 cans. While this is perhaps the most glaring example of excess variety in container sizes, the consensus of opinion seems to be that much is to be gained through a general simplification program.

It is also recognized that the canning industry must undertake through their specialized associations additional research and study of distribution. An indication of the lack of knowledge as to what others in the trade are doing is apparent in the recent discovery that there is a large amount of cross-hauling in the distribution of canned goods. It is contended that it is not in the interest of the industry for Maryland to be furnishing canned goods to Wisconsin, when there is a local output of the same commodities of comparable quality which in turn is being shipped to Maryland. A study of that phase of distribution would show, conceivably, that large amounts are being expended annually on unnecessary freight charges. The saving could be split with the consumer.

The value of distribution studies has been emphasized anew by the obvious value of the results obtained in the survey of confectionery distribution. This particular survey dealt principally with the relation between production and the size of the factory, the channels of distribution, and the physical movement of finished and raw products.

Added Flavor, Color and Aroma

Significance is attached by food specialists in Washington to the progress being made in accentuating fruit flavors, colors, and odors by means of essential oils and other materials devised for the purpose. When done properly this conflicts in no way with the spirit or the letter of the pure food laws. In fact, the Bureau of Chemistry itself has done a great deal of work on these problems. A great advance has been made in the technique of these processes, with the effect that present day results are in sharp contrast with the crude efforts of a few years ago. Such processes are needed to a greater extent in this day of mass production when it frequently is necessary to speed up the ripening process. This makes more necessary than ever the use of processes looking to the restoration of the natural properties of fruit. A factor of interest to public officials in this connection is the large amount of waste that is eliminated as the result of these processes.

Export Opportunities

IF AMERICAN manufacturers can build an industry that has made the United States the world's largest exporter of macaroni, when the country a few years ago imported practically its entire requirements of this particular foodstuff, the country's genius for mass production and the substitution of machinery for hand labor will enable it to repeat the process in multiplied instances, it is believed at the Department of Commerce. Food specialists working on problems of foreign trade are convinced that the possibilities of export in processed foods are great. As reconstruction proceeds in Europe and the economic status of great populations in Asia and Africa rises, there will be an increasing demand for such foods. For that reason they are doing all they can to turn the thought of American manufacturers in that direction.

Another example of American ingenuity which has built a great industry is the trade in California sardines. These fish are not marketable in the United States, but have been so popularized in the Far East that their exports now exceed that trade in salmon. This is cited by the Department of Commerce to demonstrate that the possibilities of the export trade are by no means confined to the higher priced foods.

There is no attempt to deny that the total exports of foodstuffs from the United States will decline gradually. There was such a decline for fifteen years before the war. Exports at pres-

ent are double the pre-war figure, but the decline will come largely in bulk commodities and in packinghouse products. As European agriculture gathers momentum it is obvious that there will be less demand for our grain and grain products and as the livestock situation becomes more stabilized it is apparent that purchases of meat products will decrease. Incidentally, the world market for wheat products has been affected by the feminine fad for the boyish form. The fact that the fad is reflected in the styles sent out from such world centers as Paris, London, and New York has had the effect of spreading this craze to the four corners of the earth. In like manner, consumption of beef has suffered because of the impression that it is a cause of rheumatism and allied maladies. There is some division in the medical profession on the subject but it has not yet been explained why non-carniverous lower animals suffer from such ills.

Recent press reports to the effect that British interests are planning a large canning industry to put up the fruit crop of the British Isles, are discounted at the Department of Commerce. A strong suspicion is expressed that the agitation of the idea emanated from the Welsh tin plate industry. It is pointed out that the principal canned fruits consumed in England—peaches, pears, and apricots—are not raised there to any considerable extent. It is believed, however, that the English strawberries, what there are of them, are particularly suited for canning purposes.

The American fruit that is gaining most in the British market is the grapefruit. The London office of the Department of Commerce has estimated that the British public is consuming an amount of that fruit ten times greater than five years ago. While it is believed that American prepared foods have a large potential market in England, it is felt that a heavy investment in advertising is essential to success. It is also pointed out that when the British consumer begins to use any considerable quantity of a processed food, it does not take British industry long to enter the competition, or for the American manufacturer to erect a plant there.

With the dairy industry suffering from over-expansion, the British Isles is taking up poultry raising to an extent greater than ever before. As a result an important demand has sprung up for American-made poultry food.

Reports from the Commerce Department's representatives in Denmark and Norway indicate that improved business conditions in these countries will lead to an increased demand for American export products. The high standard of living prevailing in those countries present market possibilities for American prepared foods, the reports say. Before this trade can be increased however, it is thought by those following the situation that American producers will have to be induced to pay more attention to sales promotion and to advertising.

Denmark at present obtains nearly seventy per cent of her dried and fresh fruits from America and ninety per cent of her apples. The dried fruit trade, it is stated, was formerly dominated by Italy and Spain, but the higher grade American product practically has crowded out the southern European goods. Until six years ago practically all the raisins sold in Denmark came from Spain, but now seventy per cent of imports comes from the United States. In fact, American raisins have crowded out the European product in nearly all part of the world. Due to the perishable nature of the product and to the large stocks, it is expected that the export of raisins during the next few months will be in unprecedented volume. The low price of American raisins is being reflected in the composition of bakery products throughout Europe, where they are being used in a wide variety of bread and cake. The bakers are finding that the use of raisins enables them to collect an additional price which allows them slightly more profit. This trend seems to be popular with the consumer and it is expected that a permanent increase in demand will result.

Italy offers a promising field for American canned fruits, in the opinion of Miss Elizabeth Humes, assistant commerical attaché of the Commerce Department in Rome. There is little demand, however, for American canned vegetables and soups because of the high import duty Italy levies on these articles. Considerable wheat and wheat products are imported from the United States when the market is favorable. When Russia was an exporter of wheat much of Italy's requirements came from that country. At present most of Roumania's surplus is marketed in Italy. Argentina is a strong competitor in the Italian wheat market and frequently is in a position to undersell American exporters.

Food Industries Plan To Spend $14,516,000 for New Plants

The food industries in the last month have laid plans for the construction of $14,516,000 worth of new plants. These 71 plants-to-be range in cost from $30,000 to $3,000,000, and average $205,000. Detailed news of them is given on p. 47 of this issue.

NEW CONSTRUCTION is a regular feature of *Food Industries*. It helps both buyer and seller, bringing them together with the least effort on the part of either. The man needing equipment will find himself in direct contact with the widest and most attractive market. The man who sells will be shown where the demand lies.

This month's opportunities include the following: Nine packing plants worth $1,737,000; seven milk plants, $1,045,000; 14 bakeries, $1,390,000; 3 cold storage plants, $2,150,000; and grain elevators, ice cream factories, bottling plants and breweries in notable numbers.

Standard Container Sizes Fixed for Preserves, Jellies, and Apple Butter

Definite and general agreement was reached at the recent Cleveland conference as to standard stock sizes of glass containers for preserves, jellies, and apple butter. Meeting under the auspices of the simplified practice division of the U. S. Bureau of Standards and in conjunction with the mid-year convention of the National Preservers Association, representatives of glass container makers, jam, jelly, and apple-butter makers, and distributors of these commodities accepted the proposals which reduced the number of sizes of preserve jars from 36 to 8, of jelly glasses from 24 to 7, and of apple-butter jars from 6 to 4.

The standard sizes agreed upon for preserve jars are defined by net weight of contents in avoirdupois ounces; the sizes are 2, 4, 8, 12, 16, 32, 43 (equal to 32 fluid ounces), and 64-ounce containers. The corresponding standard sizes for jelly glasses will be 2, 4, 6, 8, 10, 12, and 16-ounce containers. Apple-butter jars, to be standard, will be of 7, 14, 28, or 38 ounces avoirdupois content. (The last-named size is the 32 fluid-ounce container.)

It was the decision of the conference that these standard sizes would become effective for *production* after January 1, 1929, to be continued without revision for a year. A longer period before the effective date for complete compliance in the *distribution* of these commodities exclusively in standard-size containers was deemed necessary in order to allow time for working off of old stocks of both containers and packed goods. The effective date governing distribution will be January 1, 1930.

In order that the simplification program may be revised in any respects that may prove necessary by the end of its first year of operation, it was agreed that there should be a standing committee from the industry to take charge of this matter and to work under the plan which is recommended by the Department of Commerce. This standing committee will consist of three representatives of the Glass Container Association, three representatives of the National Preservers Association, and three distributor representatives, one each from the National Wholesale Grocers Association of U. S., National Association of Retail Grocers, and National Chain Store Grocers Association of U. S. In carrying out this simplification program this committee will work on the basis that practically unanimous agreement of the industry and wholly voluntary co-operation are the basis of establishment and maintenance of standard sizes. The government representative in charge of this conference emphasized the fact that the Department of Commerce does not wish to have any mandatory function, but wishes to afford any facilities which it may possess that will facilitate complete voluntary co-operation.

Swampscott Meeting of American Chemical Society Has Many Papers of Interest to Food Manufacturers

Editorial Staff Report

STANDING room only was available at the meeting of the American Chemical Society at Swampscott, Massachusetts, September 10th to 15th, when the Division of Agricultural and Food Chemistry met for its principal sessions. The following officers of the Division were re-elected for 1928-29:

Chairman, Dr. F. C. Blanck, in charge of the Food Research Division, Bureau of Chemistry and Soils, U. S. Department of Agriculture.

Secretary, Dr. H. A. Schuette, Professor of Food Chemistry, University of Wisconsin, Madison, Wis.

The Symposium on "Chemistry and the Food Industries" occupied the attention of the members for two days.

Dr. C. B. Morrison of the American Baking Institute, Chicago, outlined the history of the connection of science with this ancient industry, from the first known book on baking written by Malouin in 1767 up to the present. He stated that Dumas in 1840 introduced the baking test as a means of determining the suitability of a flour for baking and since that time although many chemists have studied flour intensively no real improvement has been developed better than the baking test, devised nearly a century ago.

Laboratories in bakeries have been made necessary by the problems involved in mass production and the use of automatic baking machinery. The chemist has worked out optimum temperatures and pH fairly satisfactorily, yet an immense amount of work remains to be done.

To be of real help to a baker, Dr. Morrison believes that the chemist should be a baking technologist as well as a scientist, pointing out that science has not yet caught up with the art and many problems remain to be solved. For example, the dough fermentation is re-stated each generation in terms of the language and theories of that generation and progress toward a complete comprehension of this fermentation must be dependent on the further developments of related sciences.

Time studies of fermentation have not been made, nor has the stale bread problem been solved. A practical solution of the latter would save the bakers hundreds of thousands of dollars each year. Baking, he concluded, is not a scientific process but still remains an art owing to the variables that still exist—flour and the biological process of dough fermentation.

"Chemistry and The Beverage Industry" was discussed by Dr. F. M. Boyles, President of Jack Beverages, Incorporated, Brooklyn, who limited his subject to carbonated beverages only, thus omitting the cereal or brewed drinks.

The carbon dioxide used in carbonated beverages has been produced in part by fermentation, in connection with which an important contribution by chemistry has been the complete removal of traces of impurities that might have an objectionable flavor or odor. Thirty years ago the only flavors available were strawberry, lemon, and sarsaparilla while today many more are at hand, to which development the chemist has been the chief contributor. The chemists' success has been so great that in a recent test 79 per cent of nearly a hundred persons who tasted a carbonated grape drink preferred one prepared with a synthetic grape flavor to the natural flavor. Recent Federal Trade Commission rulings, however, have complicated the chemist's problems inasmuch as the commission held that the advertisement of fruit-flavored drinks may not show a picture of the fruit concerned unless flavored wholly by the actual fruit.

Also were discussed the amount of carbonation possible without obscuring the flavor and the problems involved by impurities of hard water, as well as metallic contaminations. The most recent development in the carbonated beverage field is bottled milk chocolate and it has presented a problem to the manufacturer, involving, as it does, complete sterilization. Its manufacture has been abandoned by many on account of this difficulty. The chemists and bacteriologists have met and solved many problems and only by their help can a manufacturer continue operations because of the liability of spoilage of a milk drink, as well as its coagulation in case of failure to adjust the pH of the ingredients to neutrality before mixing.

"Chemistry and the Cocoa and Chocolate Industry" was presented by Dr. Frank C. Gephart, consulting chemist, New York City. Forty per cent of the world's annual production of cocoa, amounting to 200,000 tons, are used in the United States. Cocoa as a human food dates back to the days of Cortez. He briefly sketched the cocoa fermentation which is generally carried out by natives of tropical countries and is not adequately understood. Roasting, which is done in our own country, is a process that the chemist has not studied in detail and is largely uncontrolled at present, and yet has a very important bearing on the flavor of the finished product.

The lack of control of the manufacture of Dutch Process Cocoa, or soluble cocoa, was also stressed by him. He instanced the work of Blumburg of the Bureau of Chemistry who showed that water extraction of soluble cocoa did not yield any more substance than did the corresponding extract of cocoa powder, thus indicating no greater solubility. Cocoa butter has long been known for its resistance to rancidity. Gephart offers a new theory to explain this property, namely, that probably the correct explanation is to be found in the fact that during its manufacture cocoa butter never comes in contact with water.

The graying of chocolates is one of the big problems of the industry today and is due to the cocoa butter melting and coming to the surface in periods of high temperatures. Thus far, a quick turn-over in the trade is the best solution that has been reached. He further stated that with the present increased demand for cocoa butter the condition has arisen in which the cocoa powder has become a byproduct of its own manufacture instead of remaining the major product. Other unsolved problems of the industry embrace, in part, a study of the digestibility of the protein of the cocoa and a study of the constitution of the alkaloids found in this product.

Mr. C. P. Lathrop of the National Preservers Association, Washington, D. C., traced "The Relationship of Chemistry to the Jam, Jelly and Preserve Industry." In this talk he pointed out that the chemistry of the subject is largely the chemistry of raw products, particularly the chemistry of fruits. It would be of great help to the chemist in this field if he could know definitely the constituents of flavors and natural colors. Some work has been done along these lines but much more remains to be done. The separation of tartrates from grape juice by freezing, and the employment of diastase to remove starch from apple juice, are two contributions of chemistry that have been of material aid to the manufacturer. Many of the problems of the chemist, he said, seem to be capable of solution only through the development of new or better varieties of fruits in which the horticultural problem will be solved by co-operation with the chemist.

Preservation of the texture of the fruits indicates that in this respect sugar materially helps cold packing. The necessity of destroying enzymes is important, for it must be recognized that fruit is a living tissue that may ultimately soften because of its own metabolic processes, even if spoilage of bacterial origin is eliminated. The flavor and color of fruits are at their best immediately after the hard stages of ripening has passed and mellowing has commenced. This, however, is accompanied by loss of acidity and dissolution of the pectin, which is the cement that holds the structure together. To obtain color or flavor at their best and at the same time to maintain the fruit structure, is the problem of the preserve chemists. Lathrop believes that pectin or acid should be added to fruits ripened to the point of slight deficiency in this respect if

their use will produce a better product.

"Chemistry and Food Regulation" was treated by Dr. P. B. Dunbar, Assistant Director of Law Enforcement, Bureau of Food, Drug and Insecticide Control, who showed the difficulties that faced the food chemist back in 1906 when the food control laws first came into being. Analytical methods have been developed as new problems arise. Despite the fears that federal regulation of foods would ruin the industry it has had a decidedly beneficial effect. The fact that one-half the papers on the program were by "graduates" of the Bureau of Chemistry was construed as sufficient evidence to demonstrate that manufacturers feel the need of control chemists. To regard the chief aim of the enforcement division as the prevention of adulteration is to overlook the fact that today adulteration is the exception rather than the rule. As a result of its activities, he declared, the American public can get better food for its money than can the people of any other country.

Dr. B. H. Smith of the Virginia Dare Extract Company, spoke on "Chemistry and the Flavoring Extract Industry." His remarks were prefaced by a short introduction to the physiology of taste sensations, emphasizing the fact that it is necessary for a product to possess odor before it can serve as a flavor. This is because the human tongue, unaided by the sense of smell, can distinguish but few flavors. Coumarin, first produced in 1876, was the first artificial flavor. Since then many artificial synthetic flavors have been produced. He urged upon his hearers the need of fundamental chemical research designed to produce adequate data showing the effect of the substitution of various organic radicles in the molecule of a flavoring substance. When possessed of such informaton the flavoring chemist will be able to produce flavors to much better effect than is possible today.

His talk was suggestive of other lines of research, particularly his urging the synthesis of the higher esters of anthranilic acid as a probable fruitful field of endeavor. For some flavors we shall probably have to look to the horticulturist. His assistance to the flavoring industry will be best given by developing better flavored varieties of fruits.

As a representative of over 11,000 citrus fruit growers, Dr. C. P. Wilson of California discussed "The Relation of Chemistry to the Citrus Byproducts Industry." In America, citrate of lime production began in 1893 and in 1916 citric acid itself was first produced by treating the calcium citrate with sulphuric acid, followed by filtration, evaporation, and crystallization. With respect to essential oils chemistry plays a negative rôle, to the end that its chief endeavor is to preserve the original quality of the oil and prevent its deterioration. Metals such as copper have an extremely deleterious effect while glass or certain resistant alloys are the best materials to use in contact with this group of essential oils.

In analytical procedure chemistry is important but the final judgment of quality is based upon organoleptic examinations, showing, in other words, that taste and smell can detect constituents that chemistry thus far has failed to identify. Another byproduct of the citrus fruit industry is preserved fruit juice, either concentrated or in powdered form, and one involving problems that require both chemistry and bacteriology to effect a satisfactory solution. After the essential oils are removed, orange and lemon peel have a distinct animal food value, ranking close to barley in this respect and considerably above beet refuse or alfalfa. This, he stated, was of great importance to Califronia where fodder is always scarce.

Aided by the results of researches of Tarr and others at the Delaware Agricultural Experiment Station the citrus byproducts industry has been studying the production of pectin from citrus fruit sources. In the Citrus Fruit Growers Exchange laboratory much study has been given to the evaluation of pectins for jelly grade or of jelling strength and much has been contributed by it to our knowledge of pectins. Aside from their use for jellies pectin is used as an emulsifier and as a protective colloid.

"Shortening" was the subject of a talk by Dr. M. B. Graff of Proctor & Gamble Company, Cincinnati. Many of the problems of the chemistry of shortening are largely the problems of the uses of the product. Control of consistency is highly important for the baker. In the production of hydrogenated oils the purification of hydrogen is a difficult matter and serves to emphasize an old saying among chemists that a method is not a process. He showed that unmelted and melted shortenings do not have the same shortening value thus indicating a considerable gap in our knowledge of the function of this component in baking.

The difference between a spice and a flavor, namely, that the former possesses flavor plus pungency, was brought out in his discussion of "The Spice Industry" by Dr. John Glassford of McCormick & Company, Baltimore. There exist three general classes of spices: aromatic; aromatic and pungent; aromatic and pungent both as to odor and taste. The chemistry of spices is usually the chemistry of essential oils although in the flavors of spices resins and alkaloids have a rôle which is not entirely understood. For example, many spices of different flavor possess essential oils that are identical in composition and yet taste unlike, indicating that there must exist some, as yet unidentified, components that are present in minute amounts and are responsible for the differing flavors. In analytical procedure, he showed that non-essential constituents played an important rôle. In fact, he regarded it as too important and, owing to this factor, the laboratory figures cannot be used solely as a criterion of quality upon which purchases may be based. He urged that more study be given to this group of foods in order that more adequate analytical methods may be devised.

While cattle were in man's possession as far back as 4000 B.C. "The Chemistry of the Dairy Science" dates back only to the XIX century, said Dr. George E. Holm of the Bureau of Dairy Industry in his discussion of that subject. The dairy industry is still in the expansive stage of development and has not yet reached the intensive stage. Equipment and the methods employed have been adopted from other fields. As an example, the industry is indebted to the enamel chemist for the development of the insulated glass lined tank car. For a considerable time the rôle of the chemist here has been to keep production up to the standards imposed by outside authority.

Increase in production has not caused over production but, on the contrary, there has been a tendency for production of dairy products to lag behind population increase. The manufacture of butter, desiccated milk, casein, casein plastics, casein adhesives, and cheese were treated in his talk. On the subject of processed cheese, he said that the chemist has contributed a method whereby a cheese that might fail, through some detail of appearance, to measure up to number one quality can be reworked satisfactorily, after the addition of small amounts of substances possessing highly negative ions such as citrates, or tartrates, and then subjected to proper heat treatment.

Whey is a product that is frequently wasted because of the need of some good method of lactose recovery. Adequate financial impetus to such studies is lacking because of the relatively few uses for lactose; it is unfortunate that what may be done with lactose may usually be done more cheaply with another sugar. The work of Beach in California, however, on lactose as a remedy for cocciodosis, a sporozoan disease of fowls, may open a new field for the use of lactose. Evaporated milk, powdered milk, and ice cream were also discussed.

"Chemistry and the Breakfast Food Industry" was the topic of the talk by Mr. O. C. Stanger of the Carl S. Miner Laboratories, Chicago. Our gradually changing habits of life have been the stimulus to studies of breakfast foods and the slow cooking rolled oats have had to give place to a quicker cooking product. This development was attributed by Stanger to mechanical men and not to chemists for the latter have not been able to produce a quick cooking oat meal by chemical means. The chemist in this industry has been very useful, he said, in relation to advertising for he has helped to eliminate undesirable innuendo from advertisements. In control work his efforts are, of course, necessary. The discovery of a cheap method of furfural production resulted from efforts of research chemists to produce a cattle food from oat hulls.

Western Cannery Merger Not Yet Effected

Options of approximately thirty canning plants in Utah, California, Idaho, Oregon and Washington have been renewed until October 15th by Guy C. Meyer of Billings, Montana, in order to enable the promoters of the proposed merger to have additional time in which to complete their work.

It is intimated that plans are under way to include several eastern canning concerns in the proposed corporation in order to have a better balanced economic structure as the basis for future financing.

Food Control Officials Approve Haugen Bill

In convention assembled at Hartford, Conn., the Association of American Dairy, Food and Drug Officials officially decreed that the so-called colored cooking fats are, in fact, oleomargarine. The Food Commissioners further stated that such products should be taxed and their manufacture and sale controlled in the same way that oleomargarine is taxed and controlled. Their action was based upon the fact that during the past few years certain fat compounds, typified by "Nu-Ine" of Baltimore, have been labeled and branded "shortening products," apparently intended for shortening and cooking purposes only. Such products are compounds of vegetable oils, chiefly cocoanut and peanut oils, water, salt and a yellow color, made in imitation of butter, and are being sold as butter.

Being manufactured and sold tax-free, these highly elaborated "cooking fats" have played mild havoc with the regular oleomargarine market because of the relatively wide price margin in their favor. With that thought in mind the Food Control officials endorsed the Haugen Bill, as amended, known as H. R. 10956 and intended to include them legally among other forms of oleomargarine.

Nitrogen "Canning" Experiments

To arrest the development of softening and rot in peaches after picking them from the trees, experiments have been conducted at Hammonton, N. J. by Thomas F. MacGregor and Robert J. Ragan of Philadelphia, under the auspices of the Hammonton Chamber of Commerce, in which sound ripe fruit was hermetically sealed in tin containers after replacing the air by pure nitrogen. It is understood, however, that similar experiments in England employ refrigeration in addition to nitrogen.

The softening of sound ripe horticultural products after they have passed their period of best quality is due to metabolic processes associated with life. The peach is a living thing and to maintain its life a supply of oxygen is necessary and is used by the fruit to oxidize a part of its substance, thus bringing about its softening and ultimate unfitness for human consumption. When in this over-ripe condition its tissues are an easy prey to microorganisms that cause rot.

By replacing air with nitrogen the atmosphere surrounding the peaches in the container is theoretically devoid of the one thing the peach needs to continue its softening and ripening processes; as a consequence preservation by this means could be predicted. The formal experiments begun at Hammonton on August 28, 1928 will test the theory and although it is still too early to venture an opinion the results of the first inspection made on Sept. 18, after a period of three weeks gas storage, indicate an unusual preservative effect. Whether one may truthfully state that the process is merely one of asphyxiation of the peach remains for the future to decide. Further progress of the experiments will be watched with considerable interest because the prediction has been made that if the trial proves to be a commercial success gluts in the market will soon be a thing of the past.

MANUFACTURERS' CATALOGS

The LaMotte Chemical Products Company, Baltimore, Md. (4th edition).—The A.B.C. of Hydrogen Ion Control. From modest beginnings this publication has assumed the proportions of a book that is now being employed occasionally as a scientific text in some of the institutions of higher learning. To the food manufacturer in many lines, hydrogen ion concentration, or pH, is of great importance. The LaMotte company has assembled many applications of the control of this factor, including water purification, sewage disposal, industrial waste, sugar manufacture and refining, glucose, corn sugar and candy, gelatin, fermentation, fruit jelly, flour, bread and dough, crackers, milk and milk products, canning of food products, cleaning processes. Applications to other industries are also presented.

Policy Holders Service Bureau, Metropolitan Life Insurance Co., New York City—Index of Publications. A listing of booklets available to all business executives as a guide to better business management, production, marketing and distribution, advertising and publicity, personnel relations, accident prevention and industrial health and hygiene. Of interest to the food manufacturer are "A Budget for the Ice Cream Industry," "Budgeting for the Canner," "The Use of Research in Developing Old Products and Introducing New Ones," "Bettering Production Methods Through Research," "Marketing California Grapes."

OBITUARY

ANDREW ROHAN, oleomargarine manufacturer, whose fortune was based on the fact that he took a chance on a new product which his business competitors had refused to handle, died in Cincinnati on the 16th of September, in his sixty-ninth year. He was stricken with a cerebral hemorrhage while attending a business conference.

Thirty years ago Mr. Rohan became a commission merchant, later establishing the Andrew Rohan Company, wholesalers of butter, eggs and cheese. Somewhat later a Chicago business man who had started producing a new table product called butterine came to Cincinnati in an effort to obtain a local distributor for his artificial butter.

Some of the commission merchants laughed at the Chicagoan. Others admitted that the product might have merit, but asserted that their customers would never accept a substitute for butter.

But Andrew Rohan had waited on the ultimate consumers himself as a grocer and was satisfied that the public would eat a butter substitute if confident of its purity and wholesomeness. He took a chance and became Cincinnati distributor of the Chicago product.

In 1902 he decided to make his own butterine and established the Ohio Butterine Company. In 1920 he was one of the organizers of the Churngold Corporation. Both the Ohio Butterine Company and the Andrew Rohan Company became subsidiaries of the new corporation of which he was the president and which is now one of the largest producers of oleomargarine in this country.

S. BROWN RICHARDSON, well known cheese maker of Lowville, N. Y., died on the 1st of September, at the age of seventy-six.

Soon after graduating from Rochester University in 1878 he formed a partnership with his brother under the firm name of R. J. Richardson and Company, dealing in general agricultural products and cheese. He purchased the interest of his brother in 1883. On the death of his father in 1917 he took his sons, Harold J. and Raymond S., into the business which was then called Richardson & Company and today is a part of the Kraft-Phenix Cheese Co. Mr. Richardson was one of the organizers of the Lowville Cold Storage Co., Inc., one of the larger cheese cold storage companies of the country.

Probably the outstanding contribution that he made to the cheese industry was his development of sales to the domestic market in the East at a time when the principal outlet for cheese was the European markets. In addition to being a cheese dealer he owned many cheese factories, was president of the Lewis County Condensery, vice-president of the National Exchange Bank of Carthage, N. Y., and a director of two other banks.

PRACTICAL · OPERATING · DETAILS

Sanitary Tank Gage

By Bryan Redington
Gonzales, Calif.

A very frequent procedure about the condensed milk plant is the use of a rod for measuring the contents of the condensed milk storage tanks. This is not very accurate and has the additional disadvantage that it is not always as sanitary as could be desired. The possibility of using a gage glass on the side of the tank immediately suggests itself, but this also has been found to be unsatisfactory as it is almost impossible to keep clean and sanitary and is certain to give trouble in plugging with sour milk.

The tanks used hold ordinarily from 40,000 to 60,000 lb. of milk. It is consequently satisfactory if the contents can be measured to the nearest 100 lb. The device shown in the drawings accomplished this and was in addition, easily constructed and readily sterilized. It consists simply of a manometer which measures the pressure of air in a tube connected to the bottom of the tank. The connection is made by means of a sanitary union, attached to a fitting which has a clean-out plug. The tube is swivelled at the top from a universal joint and attached to a copper tube leading to the manometer. The glass of the manometer tube is attached to the copper by sealing with sealing wax within a brass sleeve to which the copper tube is sweated. A few rough threads cut in the sleeve insure a permanent connection.

While the mercury column may be

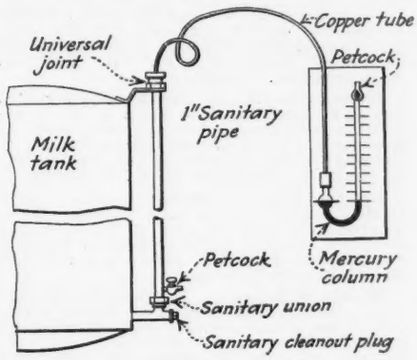


Fig. 1—Sanitary Manometer Gage for Measuring Condensed Milk

calibrated by calculation, it is usually easier to do so by weighing in quantities of 1,000 lb. and subdividing the 1,000 lb. intervals into 10 divisions. Since curved bottoms are ordinarily used on milk tanks, calibration of the first few inches is difficult and not entirely necessary. For this reason, a petcock

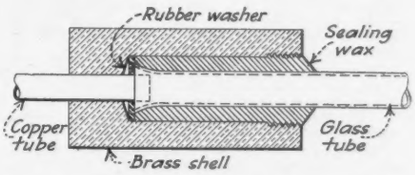


Fig. 2—How the Manometer Is Sealed to the Copper Tube

is provided at the lower end of the vertical measuring tube to serve as a zero point. Milk is carefully weighed into the tank until it runs from the petcock. Readings on the manometer are then additions to this figure.

When the tank is to be cleaned, the sanitary union is unlocked and the tube swung to one side where it can be washed with a sanitary pipe brush. After locking the union, the tube may be sterilized with high-pressure steam simply by closing the petcock on the manometer. On refilling the tank it is only necessary to open the petcock on the tube long enough to allow a few drops of milk to flow out as the milk reaches this level in the tube, to insure the proper zero point for the manometer.

· NEW · CONSTRUCTION ·

Factory and Equipment Requirements

Abattoir—P. Zetron & A. Zaskow Packing Co., Milwaukee, Wis., is receiving bids for a 2 story, 50 x 90 ft. abattoir building on Muskego Ave. Estimated cost $50,000. P. Marziller, 144 East Wells St., Milwaukee, Wis., is architect.

Bakery—Boettcher Baking Co., Pleasant Ridge and R.F.D. No. 3, Pontiac, Mich., awarded contract for a 1 story, 90 x 250 ft. bakery at Pleasant Ridge, Mich., to M. Bartholomael Son & Co., 1574 East Warren Ave., Detroit. Estimated cost $95,000. W. E. Long, 155 West Clark St., Chicago, Ill., Engr., will purchase bakery equipment.

Bakery — Dutch Tea Rusk Co., 1363 Grandville Ave., Grand Rapids, Mich., awarded contract for a 2 story bakery on Ottawa St. to A. Postma, 47 West 17th St., Holland, Mich. Equipment purchased.

Bakery — Fraser Baking Co., 6 Cherry St., Burlington, Vt., will receive bids after Oct. 1, for a 1 story, 95 x 145 ft. bakery to replace fire loss. Estimated cost $40,000. McCormick Co., Inc., 41 Park Row, New York, N. Y., is architect.

Bakery—General Baking Co., 420 Lexington Ave., New York, N. Y., plans the construction of a 2 story, 120 x 200 ft. bakery at Bronx Blvd. and Rosewood St. Estimated cost $75,000. C. B. Comstock, 110 West 40th St., New York, N. Y., is architect.

Bakery—Golsam Realty Corp., S. Silverman, Pres., 135 Broadway, New York, N. Y., plans a 1 story, 90 x 166 ft. bakery at Sedgwick and Van Cortland Aves. Estimated cost $60,000. Franklin, Bates & Heindsmann, 2526 Webster Ave., New York, N. Y., are architects.

Bakery—Hatton Realty Corp., 345 East 149th St., New York, N. Y., plans the construction of a 1 story, 100 x 100 ft. bakery at Buhre Ave. and Hobart St. Estimated cost $25,000. Cohn & Siegel, 45 West 57th St., are architects.

Bakery — Holland American Wafer Co., 1823 South Division Ave., Grand Rapids, Mich., awarded contract for a 2 story, 44 x 100 ft. bakery and steam plant to Osterink & Voss, 1621 Grandville St. S. W., Grand Rapids, Mich. Estimated cost $40,000. Miscellaneous bakery equipment will be required.

Contracts Awarded for New Plants in the Food Industries

June, July, August

	1928		1927	
	No.	Value	No.	Value
Bakeries	11	$1,459,000	14	$2,253,000
Bottling	2	140,000	2	90,000
Cereals	2	375,000	2	800,000
Chocolate	1	200,000	1	152,000
Creameries	2	140,000	2	86,000
Dairies	3	455,000	1	60,000
Flour	2	305,000	1	80,000
Fruit canneries	2	90,000	1	50,000
Ice	5	515,000	4	365,000
Packing	9	1,292,000	4	440,000
Miscellaneous	2	115,000	1	120,000
Candy	1	40,000	..	.....
Corn products	1	150,000	..	.....
Milk condenseries	3	550,000	..	.....
Produce term'l.	1	3,000,000	..	.....
Grape products	..	.....	1	80,000
Ice cream	..	.....	1	300,000
Milling, feed	..	.....	2	280,000
Sugar	..	.....	1	68,000
Tea	..	.....	1	42,000
Yeast	..	.....	1	200,000
Total	46	$8,826,000	40	$5,466,000

Bakery—Regal Bakeries, 611 Gerrard St. E., Toronto, Ont., awarded contracts for masonry, excavation, etc. for a 2 and 3 story, 70 x 200 ft. bakery on Dupont St. Estimated cost $175,000.

Bakery — G. Schepps Baking Co., 2301 South Ervay St., Dallas, Tex., awarded contract for the construction of a bakery on Henderson St. to Churchill-Humphrey, Magnolia Bldg., Dallas, Tex. Estimated cost $200,000.

Bakery Addition—Dugan Bros., Inc., 288 5th St., Brooklyn, N. Y., awarded contract for the construction of a 1 and 2 story, 200 x 260 ft. addition to bakery at 99th Ave. and 222nd St., Queens Village, L. I. to Wilcox Construction Co., Bridge Plaza, Long Island City, N. Y. Estimated cost $300,000.

Bakery Addition—Foerster Bakers, Inc., 207 North Washington St., Bergenfield, N. J., will receive new bids on revised plans about Oct. 1, for a 3 story, 100 x 270 ft. addition to bakery on South Washington St. and Rutland Ave. Estimated cost $150,000. McCormack Co., Inc., 41 Park Row, New York, N. Y., is architect.

Bakery Addition—Vienna Model Bakery, 1224 West Congress St., Chicago, Ill., awarded general contract for addition to bakery at 1214-1228 Congress St., to Krabl Constr. Co., 350 N. Clark St. Estimated cost $35,000.

Bakery Addition — Vietmeyer Bros., Inc., 175 Sherman Ave., Jersey City, N. J., is having plans prepared for a 2 story addition to bakery. Estimated cost $50,000. W. Neuman, 40 Journal Sq., Jersey City, N. J., is architect.

Biscuit Factory — Ontario Biscuit Co., 273 Oak St., Buffalo, N. Y., awarded contract for a 4 story, 80 x 96 ft. biscuit factory at 20 Waston St. to Hydro Construction Co., Mutual Bldg., Buffalo, N. Y. Estimated cost $90,000.

Bottling Plant—Coca Cola Bottling Co., J. C. Pidgeon, 1906 Overton Park Ave., P. Pidgeon, 2288 Washington St., Memphis, Tenn. and E. J. Barry, Helena, Ark., promoters, plan the construction of a 1 or 2 story bottling plant at Izard and South Front Sts., Forrest City, Ark. Estimated cost $25,000.

Bottling Plant — Eagle Bottling Works, 1912 Walnut St., Kansas City, Mo., will build an addition to bottling plant at 19th and Cherry Sts. by day labor. Estimated cost $100,000. S. C. Kenney, 715 Floyd Bldg., Kansas City, Mo., is engineer.

Bottling Plant (Soda)—Hygrade Water & Soda Co., 1314 South 13th St., St. Louis, Mo., will build a 1 and 2 story, 80 x 149 ft. soda bottling plant at 657 Tower Grove Ave. Estimated cost $40,000. Work will be done by separate contracts.

Brewery—City Brewing Corp., Cypress Ave. and Weirfield St., Ridgewood, N. Y., plans the construction of a 5 story, 42 x 42 ft. brewery including refrigeration system. Estimated cost $30,000.

Brewery Equipment—Budweiser Brewing Co. of Canada, A. C. Caldwell, Mgr., Dundas, Ont., has acquired a factory and plans to remodel and install complete new machinery and equipment including refrigeration for brewery. Estimated cost $100,000.

Candy Factory — Mars, Inc., 2019-59 North Oak St., Chicago, Ill., has work under way on the construction of a candy factory at 2019 North Oak St., Chicago, Ill. Estimated cost $500,000. Austin Co., 510 North Dearborn St., Chicago, are engineers and contractors.

Candy Factory — Oswego Candy Works, 275 West First St., Oswego, N. Y., awarded contract for a 3 story addition to candy factory to Peter Raby Contracting Co., 3rd Ave., Oswego, N. Y. Estimated cost $75,000.

Canning Plant—California Sanitary Canning Co., Los Angeles, Calif., is having plans prepared for a 2 story, 165 x 400 ft. canning plant and 1 story, 165 x 190 ft. warehouse at Long Beach Ave. and 50th St. Estimated cost $100,000. H. N. Andrews, 432 Florencita Ave., Martrose, Calif., is architect.

Cheese Factory—C. W. Lawrence, Cameron, Tex., is having plans prepared for the construction of a cheese factory.

Cold Storage Plant—Jerpe Cold Storage Co., 12th and Douglas Sts., Omaha, Neb., will soon receive bids for a 66 x 66 ft. cold storage plant at 1116 Douglas St. Estimated cost $50,000. J. T. Allan and N. S. Wallace, Brandeis Theatre Bldg., Omaha, Neb., are architects.

Cold Storage Plant—Pacific Coast Terminals, Ltd., New Westminster, B. C., has work under way on the construction of a cold storage plant, 3,000,000 cu.ft. capacity as first unit of terminal plant. Estimated to cost $2,000,000.

Cottonseed Oil Mill—Farmers Gin Co., c/o M. M. Harding, Georgetown, Tex., is having plans prepared for the construction of a cottonseed oil mill, electrically equipped near Wharton, Tex. Estimated cost $70,000.

Creamery—Marin County Milk Co., 825 4th St., San Rafael, Calif., awarded contract for a 2 story, 60 x 130 ft. creamery on Third St. to F. H. Allen, Inc., 232 Main St., San Anselmo, Calif. Estimated cost $40,000, exclusive of equipment.

Creamery—Petaluma Co-operative Creamery, Petaluma, Calif., awarded contract for a 2 story creamery at Western Ave. to W. Singleton, 501 4th St., Petaluma, Calif. Estimated cost $40,000.

Creamery and Cheese Plant — Dixie Creameries, Inc., 2419 Southern St., Shreveport, La., plans the construction of a creamery and cheese plant at Gilmer, Tex. Estimated cost $50,000. Private plans. New machinery will be required.

Dairy Products Factory—Western Dairy Products Co., 1501 4th St. S., Seattle, Wash., awarded contract for the construction of a 1 story, 120 x 150 ft. addition to dairy products factory at 1533 4th Ave. S. to Teufel & Carlson, Skinner Bldg., Seattle, Wash. Estimated cost $50,000.

Flour Mill Equipment—Elgin Middlesex Milling Co., Laidlaw, Mgr., Balmont, Ont., wants prices and catalogs on new equipment for flour mill completely destroyed by fire. Estimated cost $30,000.

Food Products Warehouse—Dossin Food Products Co., 3659 Gratiot Ave., Detroit, Mich., awarded contract for a 2 story, 40 x 142 ft. warehouse for handling food products and beverages to Banbrook-Gowan Co., 4829 Woodward Ave., Detroit, Mich. Estimated cost $50,000.

Grain Elevator—Bd. of Harbour Comrs., New Westminster, B. C., has work under way on the construction of a million bushel grain elevator on Fraser River.

Grain Elevator — The Munro Fowler Elevator Co., Wilcox, Sask., plans the construction of a double grain elevator. Estimated cost $100,000.

Grain Elevator—L. H. Pettit Grain Co., Hutchinson, Kan., awarded contract for the construction of a grain elevator, 160 ft. high 100,000 bu. capacity including four tanks to Chalmers & Borton, 720 Pioneer Trust Bldg., Kansas City, Mo.

Ice Cream Factory—Collins Ice Cream Co., W. H. Collins, Pres., c/o E. K. Eugene, 436 East 79th St., Chicago, Ill., Archt., will soon award contract for a 2 story, 150 x 200 ft. factory at State and 74th Sts. Estimated cost $300,000.

Ice Cream Factory—Schwen Ice Cream & Candy Factory, H. G. Schwen, Blue Earth, Minn., is having plans prepared for a 2 story ice cream factory. Estimated cost $30,000. C. A. Berger, 401 Phoenix Bldg., Minneapolis, Minn., is architect.

Ice Plant — Central Atlantic Ice Co., Park Ave., Summit, N. J., will build a 1 story ice plant on Morris Ave., Union, N. J. Estimated cost $80,000. Private plans.

Ice Plant—City of Duncan, Okla., having preliminary plans prepared for the construction of a 50 ton raw water ice plant. Estimated cost $100,000. H. Sullivan, Duncan, Okla., is engineer.

Laboratory—Royal Baking Powder Co., 100 East 42nd St., New York, N. Y., is receiving bids for a chemical laboratory at Kent and Maston Aves., Brooklyn, N. Y. Estimated cost $20,000. H. W. Paulus, 37-69 Ninth St., Brooklyn, N. Y., is architect.

Lemon Packing House — Alta Loma Hights Citrus Assn., Alta Loma, Calif., awarded contract for a 1 story, 95 x 137 ft. lemon packing house to Hamm, Grant & Bruner, 607 Ferguson Bldg., Los Angeles. Estimated cost $35,000.

Market Building — Syndicate, c/o Coffman, Sahlberg & Stafford, Plaza Bldg., Sacramento, Calif., Archts., will soon award contract for a 1 and 2 story, 125 x 175 ft. market building including ice and cold storage plant at Alhambra Blvd. and Granada Way. Estimated cost $200,000.

Meat Products Plant — Joseph Phillip Sausage Co., 10 Wholesale Row, Washington, D. C., is having sketches made for the construction of a meat products plant at Patterson Tract, N. E. Estimated cost $200,000.

Milk Condensery—Barnes Dairy Products Co., G. S. Barnes, Pres., Blytheville, Ark., will build a milk condensery at Rogers, Ark. Estimated cost $200,000. Work will be done with local labor under the supervision of W. C. Easley, construction engineer.

Milk Condensery — Page Milk Co, R. B. Page, Pres., Merrill, Wis., awarded contract for the construction of a 2 story milk condensery at Coffeyville, Kan. to Universal Construction Co., Coffeyville, Kan.; also 2 story, 80 x 250 ft. condensery at Marshall, Mo. to E. P. Page, Marshall, Mo. Estimated cost $100,000 and $250,000 respectively.

Milk Distribution Plant — Alderney Dairy Co., 26 Bridge St., Newark, N. J., will receive bids about Oct. 15, for a 1 story, 65 x 70 ft. milk distribution plant on Drummond Ave., Asbury Park, N. J. Estimated cost $40,000. W. E. Lehman, 972 Broad St., Newark, N. J., is architect.

Milk Distribution Plant—Newark Milk & Cream Co., c/o W. E. Lehman, 972 Broad St., Newark, N. J., awarded contract for a 1 story, 50 x 400 ft. milk distribution plant on Main St., Orange, N. J. to The Fatzler Co., 676 South 16th St., Newark, N. J. Estimated cost $75,000.

Milk Plant — H. P. Hood & Sons, 494 Rutherford Ave., Charlestown, Mass., is receiving bids for a 1 story milk plant at Quincy, Mass. Private plans. C. Y. Nourse, in charge.

Milk Plant (Powdered)—Stock Co., c/o W. D. Crothers, Chn., Brady, Tex., plans the construction of a powdered milk plant, 120,000 lbs. milk daily capacity. Estimated cost $275,000. Private plans. Machinery and equipment will be required.

Milk Plant Addition—Tibbits Milk Co., Inc., A. H. Tibbits, Treas., 38 Dallius St., Albany, N. Y., plans a 25 x 65 ft. addition to plant.

Mill and Storage Building—Quaker Oats Co., 80 East Jackson Blvd., Chicago, Ill., awarded contract for an 11 story, 85 x 113 ft. mill and storage building at Cedar Rapids, Iowa, to Leonard Construction Co., 37 West Wabash St., Chicago, Ill. Estimated cost $275,000.

Milling Plant and Grain Elevator—Maple Leaf Milling Co. of Canada, A. R. McDonald, Mgr., Dominion Bank Bldg., Toronto, Ont., plans the construction of a milling plant and grain elevator at St. John, N. B. Estimated cost $750,000.

Packing Plant—Albany Packing Co., Exchange St., Albany, N. Y., awarded contract for the construction of a packing plant to John B. Pike & Son, Inc., Arch St., Rochester, N. Y. Estimated cost $300,000.

Packing Plant—F. Dold & Sons Packing Co., 21st and Lawrence Sts., Wichita, Kan., awarded contract for a 1 story, 100 x 180 ft. meat packing plant at 21st and Topeka Sts. to Siedhoff Construction Co., Broadview Hotel Bldg., Wichita, Kan. Estimated cost $125,000.

Packing Plant — Hilgemeier Bros., 519 West Raymond St., Indianapolis, Ind., awarded contract for the construction of a 3 story, 80 x 115 ft. packing plant to W. P. Jungclaus, 825 Massachusetts Ave., Indianapolis, Ind. Estimated cost $50,000. Refrigeration system to be installed.

Packing Plant—Western Packing & Provision Co., F. Warton, Pres., 3830 South Morgan St., Chicago, Ill., had plans prepared for a 5 story packing plant. Estimated cost $200,000. B. K. Gibson, 624 South Michigan Ave., Chicago, Ill., is architect.

Packing Plant (Citrus)—Texas Packing Co., Brownesville, Tex., plans the construction of a 50 x 100 ft. citrus packing plant, 2 car loads per day capacity. Estimated cost $40,000. Private plans. Complete machinery will be installed.

Packing Plant (Citrus Fruit) — Texas Citrus Fruit Growers Exchange, Mission, Tex., awarded contract for a 1 story, 90 x 125 ft. citrus fruit packing plant at San Benito, Tex. to W. F. Chambers, San Benito. Estimated cost $550,000.

Packing Plant Addition—Kohrs Packing Co., 1343 West Second St., Davenport, Ia., awarded contract for a 2 story addition to packing plant to Priester Construction Co., Kahl Bldg., Davenport, Ia. $61,600.

Packing Plant Addition — Sioux City Stock Yards Co., G. F. Silknittel, Pres., Sioux City, Iowa, awarded contract for a 250 x 330 ft. addition to packing plant to W. A. Klinger, Inc., Warnock Bldg., Sioux City. Estimated cost $210,000.

Peanut Butter Factory—Bain Peanut Co., Durant, Okla., awarded contract for the construction of a 1 story, 80 x 100 ft. factory on Maple St. to J. P. Graham, Durant, Okla. Estimated cost $50,000. Machinery will be required.

Pickle Factory—Budlong Pickle Co., 1001 West North Ave., Chicago, Ill., awarded masonry and carpentry contract for a 1 story, 144 x 163 ft. pickle factory at 1838 Marcey St. Estimated cost $75,000.

Pie Factory — Pellar Bros., 3659 West Harrison St., Chicago, Ill., awarded contract for a 2 story, 200 x 250 ft. pie factory at 26th St. and California Ave. to William Adams Co., 209 South La Salle St., Chicago, Ill. Estimated cost $600,000.

Produce Storage Warehouse—The Great Atlantic & Pacific Tea Co., 5470 Hecla St., Detroit, Mich., awarded contract for a 3 story, 120 x 295 ft. produce storage warehouse to The Austin Co., 16112 Euclid Ave., Cleveland, O. Estimated cost $300,000.

Produce Terminal — Providence Wholesale Food Terminal, c/o Jenks & Ballou, Grosvenor Bldg., Providence, R. I., Archts., awarded contract for a 2 story, 60 x 965 ft. produce terminal including warehouse, cold storage building, refrigeration plant, power plant, service building, etc. at Kingsley, Harris and Allens Aves. to Turner Construction Co., 178 Tremont St., Boston. Estimated cost $3,000,000.

Refrigeration and Cold Storage Plant—New Jersey Canners Corp., c/o Edward & Green, 548 Federal St., Camden, N. J., Archts., is having sketches made for a 2 story, 100 x 450 ft. refrigeration and cold storage plant at Hammonton, N. J. Estimated cost $100,000.

Rice Mill — Capitol Rice Milling Co., Sacramento, Calif., plans to rebuild rice mill at West Sacramento, recently destroyed by fire. Estimated cost $200,000.

Sausage Casing Factory—S. Oppenheimer & Co., 2700 South Wabash Ave., Chicago, Ill., awarded contract for the construction of a 1 story, 125 x 155 ft. sausage casing factory at Root St. and Lowe Ave., to Regan Construction Co., 228 North La Salle St., Chicago, Ill. Estimated cost $150,000.

Stock Yard and Dairy Cattle Barn — Milwaukee Stock Yards Co., 19th Ave., Milwaukee, Wis., R. H. Schelll, Gen. Mgr., awarded contract for the construction of a stock yard and dairy cattle barn to H. Dauischefsky, 1484 Humbredt St., Milwaukee, Wis. Estimated cost $350,000.

Warehouse (Sugar Products) — W. H. Edgar & Son, 1924 Lafayette Blvd., Detroit, Mich., awarded contract for a 2 story, 155 x 190 ft. warehouse for sugar and sugar products on Dequindre St. to Martin-Krausman Co., 955 East Jefferson Ave., Detroit, Mich. Estimated cost $150,000.